SANArray Manager™ Client Software for Mylex External Controllers

Installation Guide and User Manual

for Software Kit 5

SA67-0050-01

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Installation Guide and User Manual

for Software Kit 5

Form Number SA67-0050-01

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About This Manual

This installation guide covers the steps involved to install and use the client component of Mylex's SANArray Manager™, with Mylex External Disk Array Controllers for Software Kit 5.

For information on installing and running the *server* component of SANArray Manager, consult the appropriate *Global Array Manager Server Software Installation and User Manual* for Software Kit 5.

Conventions

Throughout the manual, the following conventions are used to describe user interaction with the product:

`bold`	The user must enter the bold text exactly as shown
↵	Press the Enter key, or
Enter	Press the key labeled "Enter" (or "Delete", etc.)
File->Run	Select the Run option from the pull-down menu activated when the File menu pad is selected

☛ **Note**

Supplementary information that can have an effect on system performance.

⚠ ***Caution***

Notification that a proscribed action has the *potential* to adversely affect equipment operation, system performance, or data integrity.

STOP **WARNING**

Notification that a proscribed action will *definitely* result in equipment damage, data loss, or personal injury.

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Chapter 1
Introduction

Overview

SANArray Manager™ (SAM) Client software manages the SANArray family of External RAID controllers. This manual provides information on SAM Client for Software Kit 5. Software Kit 5 supports new server features for the following controllers:

- SANArray FFx, FFx-2

If you are using Mylex controllers that are not listed above, refer to the SANArray Manager Client Installation and User Manual for Software Kit 4.

SAM Client software is used to:

- Monitor, manage, maintain, and configure Mylex Disk Array Controllers and the physical and logical drives that are connected to these controllers, even across remote servers.
- Monitor and manage physical devices that are connected to these adapters, even across remote servers.

SANArray Manager Components

SAM has two components:

- Global Array Manager™ (GAM) Server component (which is part of the Mylex Disk Array Controller Software Kit)
- SAM Client component

Each component handles specific tasks based upon the selected function.

Configuration Functions

Configuration functions are easily performed using RAID Assist™, an intuitive, wizard-like utility in the SAM Client component that simplifies the process of setting up or reconfiguring a disk array. Just answer a few brief questions, and RAID Assist automatically does the rest. Use Manual Configuration for more control over drive group setup or individual configuration parameters.

Monitoring Functions

The GAM Server component collects and disseminates information on disk array status and resource utilization. The SAM Client component organizes this information through an intuitive graphical display. Errors and events are recorded in a log file and in the Log Information Viewer window, and if a problem is serious enough to warrant immediate attention, operators can be alerted via popup windows if so desired.

Maintenance Functions

The SAM Client manages or performs maintenance on individual disk arrays and drives (with the appropriate authentication), again by means of the graphical user interface. This includes removing physical devices from operation in a functioning disk array (also known as “killing” or off-lining a drive), rebuilding drives, selecting hot spares, and initiating a consistency check (or parity) on arrays that are configured to support redundancy. The GAM Server executes the management instructions specified by the SAM Client.

Requirements

Since SAM is a *client/server* application, the GAM Server software component provided in the Mylex Disk Array Controller Software Kit must be installed in one or more file servers in order for the SAM Client software component to operate. Hardware and software requirements for installation and operation of the GAM Server component are described for each supported network operating system in the *Global Array Manager Server Software Installation Guide and User Manual*.

Client Hardware and Software

- PC with an 80486 (or higher) class processor and at least 4 MB of system memory (Pentium® processor and 16 MB of system memory are recommended)
- Network interface card connected to a functioning network
- Appropriate network device drivers for the installed network interface card
- For proper client component connectivity, installed and functioning GAM Server software component *on the server*, under any of the supported operating systems
- CD-ROM drive for CD-ROM installation, or 3 1/2-inch disk drive for diskette installation
- Fixed disk with at least 8 MB available free space (16 MB recommended)
- Mouse or other pointing device
- A minimum display screen setting of 800 x 600 is recommended. However, we recommend setting the display at 1024x768 for optimum SAM client viewing.
- For SAM Client component installation and operation: Linux, Microsoft® Windows® 2000, Windows NT® 4.0, Windows 98, Windows Me™, or Windows® XP, installed on a local hard disk
- TCP/IP stack installed

Refer to your server documentation and to the Windows documentation for more information on hardware and operating system requirements.

Chapter 2
Installation

Installation Overview

Installation of the SAM Client component requires one of the following operating systems:

- Windows 2000
- Windows NT 4.0
- Windows 98
- Windows Me
- Windows XP
- Linux (using Wine)

This chapter assumes that the network administrator for this site will be performing these installation procedures.

If you are installing SAM Client, you may also choose to install GAM Server and its subcomponents at the same time on the same system. When installing GAM Server, dialog boxes for the server component appear and require a computer restart before launching the SAM Client software. Refer to the appropriate *Global Array Manager Server Software Installation Guide and User Manual* for GAM Server installation instructions.

Installing SAM Client with Windows Operating Systems

SANArray Manager software is shipped on an accompanying distribution CD-ROM. The file list (and path) is as follows (where X: represents the drive letter of your CD-ROM drive):

X:\GAM\WINNT\ (or X:\GAM\WIN2K\)

INST32I.EX	_USER1.HDR	OS.DAT
_ISDEL.EXE	DATA.TAG	SETUP.EXE
_SETUP.DLL	DATA1.CAB	SETUP.INI
_SYS1.CAB	DATA1.HDR	SETUP.INS
_SYS1.HDR	LANG.DAT	SETUP.LID
_USER1.CAB	LAYOUT.BIN	

1. If you intend to install GAM Server with SAM Client, make sure TCP/IP is installed and functioning properly.
2. Insert the distribution CD-ROM into your CD-ROM drive.

   AutoRun will cause the CD-ROM to display the Mylex RAID Management Software Installation menu (Figure 2-1).

Figure 2-1. Mylex RAID Management Software Installation Menu

3. Click the option called “Install Global Array Manager.”

   Global Array Manager Setup will load the installation wizard.

4. After a few moments, the Welcome dialog box will display (Figure 2-2). Click Next to proceed with the installation, or click Cancel to end the installation procedure and return to the menu.

Welcome
Welcome to the Global Array Manager Setup program. This program will install Global Array Manager on your computer.
It is strongly recommended that you exit all Windows programs before running this Setup program.
Click Cancel to quit Setup and then close any programs you have running. Click Next to continue with the Setup program.
WARNING: This program is protected by copyright law and international treaties.
Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.
Next >
Cancel

Figure 2-2. Welcome Dialog Box

5. When the IBM Software License Agreement screen appears, click Yes to accept the terms of the agreement and continue.

   If you click No, you will not be allowed to continue SAM Client installation.

The Select Components dialog box is displayed as shown in Figure 2-3. At this point you, will select the component(s) you wish to install.

Select Components
Select the components you want to install, clear the components you do not want to install.
Components
Global Array Manager Client 0 K
SANArray Manager Client 4088 K
Global Array Manager Server 0 K
Description
Requires that the Global Array Manager Server component be installed on this or some other network attached computer.
Change...
Space Required: 4088 K
Space Available: 2836558 K
< Back
Next >
Cancel

Figure 2-3. Select Components to Install

6. Select SANArray Manager Client for installation, click the box (if necessary) to check the SANArray Manager Client option.

   ☛ **Note**

   When installing SAM Client, you may also choose to install GAM Server at this time. Instructions for GAM Server installation are described in the GAM Server documentation.

7. Click Next and follow the on-screen prompts.

Installing SANArray Manager Client with Linux

Installing the SAM Client on a Linux operating system requires the use of Wine™. Wine is an application that allows Windows programs, such as SAM Client, to run on Linux. It is highly recommended that you use the Wine version from the specified web site. This version of Wine has been tested with SAM Client and we do not guarantee that our product supports other versions.

Install Wine

Go to the following web site to download Wine:

http://www.rpmfind.net

Refer to the following web sites for further information on Wine.

http://www.winehq.com

http://www.codeweavers.com

Install SAM Client

SANArray Manager software is shipped on an accompanying distribution CD-ROM. The file path is as follows (where X: represents the drive letter of your CD-ROM drive.):

X:\GAM\Linux\

Install SAM Client on Linux (where x: represents the current version number.):

rpm -ivh sam-client-5.00-xx.xxxx.i386.rpm

SAM will be installed under /opt/sam

To run SAM Client see“Starting SANArray Manager” on page 3-1.

To Uninstall SAM Client Software

1. Locate the installed SAM Client software:

   rpm -qa | grep sam

2. Uninstall SAM Client software:

   rpm -e sam-5.00-xx.xxxx

Chapter 3
Startup & Navigation

Starting SANArray Manager

Starting the SANArray Manager requires both the Server and Client components. It is not required that the Server and Client components run on the same computer; however, you must install and start GAM Server *before* you attempt to run the SANArray Manager Client.

Server Component

Installation and startup of the Global Array Manager Server component is covered in the *Global Array Manager Server Software Installation Guide and User Manual*. The software for GAM Server is provided on the installation CD-ROM.

Refer to the appropriate sections in the above-mentioned manual for instructions on starting the Global Array Manager Server component under any of the supported network operating systems.

Client Component

Under Linux, Windows 2000, Windows NT 4.0, Windows 98, Windows Me, or Windows XP you are ready to start the SANArray Manager Client once you have installed the client on your workstation (see “Installation” on page 2-1).

To start SAM Client:

- Under Windows 2000, Windows NT 4.0, Windows 98, Windows Me, or Windows XP, to start the SANArray Manager Client software select **Start->Programs->Mylex SANArray Manager Client**.
- Under Linux, type **sam**.

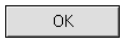
If at least one server group and file server are defined, the opening screen appears (see Figure 3-1). If not, the Define Server Groups dialog box appears (see “Navigating SANArray Manager Client” on page 3-2).

Navigating SANArray Manager Client

This section describes the navigating features and options that the SANArray Manager Client provides.

Button Controls

Dialog boxes throughout the SANArray Manager Client have a series of control buttons. Some examples of these include:



Click this button to apply the settings made in the dialog box.

Click this button to cancel the settings made in the dialog box.

Click this button to confirm the action identified in the dialog box.

Click this button to cancel the action identified in the dialog box.

Click this button to close the active dialog box.

Click this button to apply your configuration changes.

Components of the SANArray Manager Client Opening Screens

Upon startup (with defined servers), SANArray Manager Client displays the opening screen, consisting of the SANArray Manager window, the Global Status View window, and the Log Information Viewer (Figure 3-1).

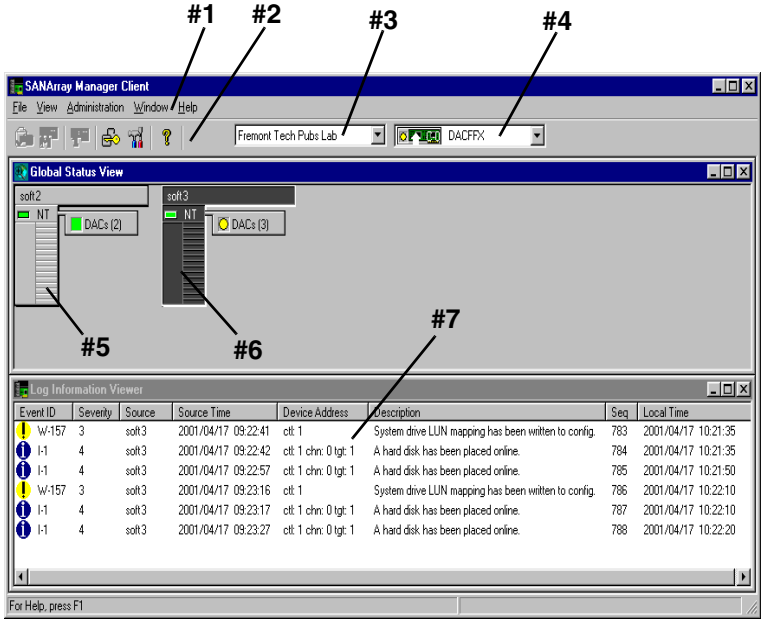

#1
#2
#3
#4
SANArray Manager Client
File View Administration Window Help
Fremont Tech Pubs Lab
DACFFX
Global Status View
soft2
NT
DACs (2)
soft3
NT
DACs (3)
#5
#6
#7
Log Information Viewer
Event ID Severity Source Source Time Device Address Description Seq Local Time
W-157 3 soft3 2001/04/17 09:22:41 ctl: 1 System drive LUN mapping has been written to config. 783 2001/04/17 10:21:35
I-1 4 soft3 2001/04/17 09:22:42 ctl: 1 chn: 0 tgt: 1 A hard disk has been placed online. 784 2001/04/17 10:21:35
I-1 4 soft3 2001/04/17 09:22:57 ctl: 1 chn: 0 tgt: 1 A hard disk has been placed online. 785 2001/04/17 10:21:50
W-157 3 soft3 2001/04/17 09:23:16 ctl: 1 System drive LUN mapping has been written to config. 786 2001/04/17 10:22:10
I-1 4 soft3 2001/04/17 09:23:17 ctl: 1 chn: 0 tgt: 1 A hard disk has been placed online. 787 2001/04/17 10:22:10
I-1 4 soft3 2001/04/17 09:23:27 ctl: 1 chn: 0 tgt: 1 A hard disk has been placed online. 788 2001/04/17 10:22:20
For Help, press F1

Figure 3-1. Opening Screen

Components of the SANArray Manager Client Windows

The major components of the SANArray Manager Client windows (Figure 3-1) are described below.

1. Item **#1** is the *menu bar*. There are five menus with several selections each. The contents of the menus and the functionality of several of the most important selections will be described throughout this guide.
2. Item **#2** is the *toolbar*. There are six toolbar icons representing seven of the most useful functions available in SANArray Manager. The identity of each toolbar icon and an explanation of the purpose of each will be described in later sections of this chapter.

3. Item **#3** is the *server group selection box*. When selected, the box displays the names of each server group that is in contact with the current client workstation. Each group may consist of multiple servers. You may select a specific server group to view, or select "All Servers" if you want to view all the servers that are defined in all server groups. The servers defined in the selected group will display in the Global Status View window.
4. Item **#4** is the *controller selection box*. When selected, the box displays the controller name (C-0, C-1, etc.) and controller type (DACFFX, etc.) of each controller connected to the currently-selected server. Also included is the controller operational status light which indicates the status of all sub-components of the controller system; (green = online, yellow = critical, red 'X' = offline). For controller dual-active pairs, a double-pointed white arrow connects the controller pair selections.

Components of the Global Status View Window

The major components of the Global Status View window (Figure 3-1) are described below:

5. Item **#5** is an icon that represents a currently *unselected file server* running the GAM Server component. The icon identifies the same information described above. There may be multiple icons displayed.
6. Item **#6** is an icon that represents the *currently-selected file server* running the GAM Server component. The icon identifies:
   - the IP address (e.g., 10.17.3.172) or name (e.g., LAB_A) of the server
   - the network operating system running on the server (e.g., 2000 = Windows® 2000; NT = Windows NT; NW = Novell NetWare, etc.)
   - the operational status of the server (green = connected, yellow = attempting connection, red 'X' = unable to connect)
   - the number of controllers connected on the server
   - the status of all controllers on that server, with a controller operational status light (green = online, yellow = critical, red 'X' = offline)

Components of the Log Information Viewer

7. Item **#7** in Figure 3-1 is the SANArray Manager Client *Log Information Viewer*. Each line in the Log Information Viewer identifies a single *event* which was noted during monitoring by a server running GAM Server, and was transmitted by that server to this client workstation. Relevant details accompany the event:
   - **Event ID**. Displays an icon showing if the event is informational, a warning, etc., plus the identification number assigned to this event.
   - **Severity**. The severity level of this event.
   - **Source**. The IP address or name of the server that is the sender of this event.
   - **Source Time**. Year, month, day, time of day at the source server's location when this event occurred.
   - **Device Address**. Relevant channel/target or other data pertaining to the origin of this event.
   - **Description**. Text of the message describing what occurred.
   - **Sequence (Seq)**. Number representing where this event fell in a sequence of possibly related events.
   - **Local Time**. Year, month, day of the month (yyyy/mm/dd), time of day (hh:mm:ss) at the *client workstation's location* when this event arrived.

Components of the Controller View Window

Open the Controller View by double-clicking any server icon in the Global Status View, or as shown in Figure 3-2:

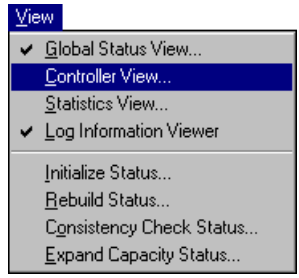


Figure 3-2. Select "Controller View"

The Controller View window (Figure 3-3 and Figure 3-4), displays the following information about the controller currently selected in the *controller selection box*:

- Item **#1:** The number of channels on this controller, each channel is depicted as a tower.
- Item **#2:** The physical devices present on each channel, specifying the target ID, capacity of the device, device type, and device status. See "Physical Device and Logical Drive Monitoring" on page 5-6 for more information.
- Item **#3:** The logical drives configured on the controller, specifying the logical drive number, capacity of the logical drive, configured RAID level, and logical drive status.
- Item **#4:** Enclosure Information and Details Button. See "Enclosure Monitoring and Management" on page 5-12.
- Item **#5:** The host device present on each channel, specifying the device inquiry data (vendor, bus width, etc...), and the device state.

> ☛ **Note**
>
> For certain FW versions one or more controller icons may be shown.

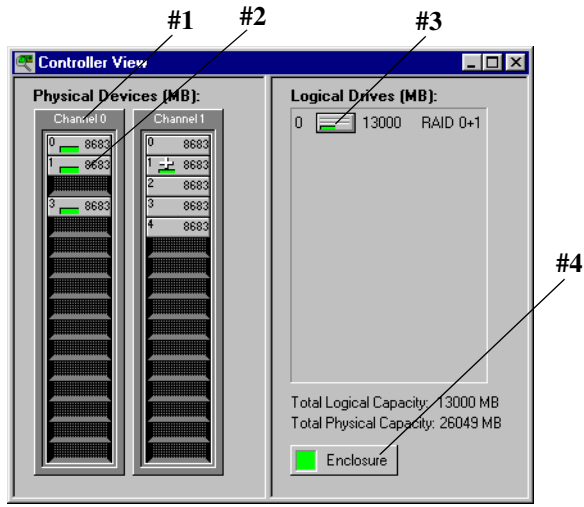


Figure 3-3. Controller View Window – "Non-Fibre" RAID Controller.

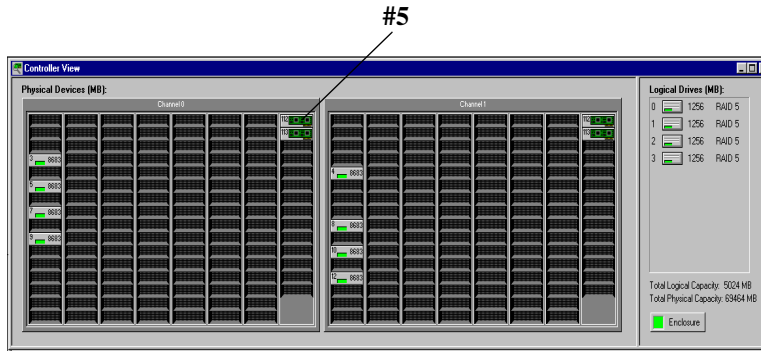


Figure 3-4. Controller View Window – Fibre-to-Fibre RAID Controller

Controller View Status Icons

The following icons display the status of logical and physical drives in the Controller View Window:

Physical Device Offline State

Physical Device Online State (configured)

Physical Device Rebuild State

Physical Device Unconfigured

Spare Physical Device

Logical Drive Critical State

Logical Drive Consistency Check State

Logical Drive Online State (configured)

Logical Drive Offline State

Menu Bar and Menus

SANArray Manager Client contains a menubar (Figure 3-5) in the SANArray Manager window.

Figure 3-5. Menu Bar

File Menu

The File menu (Figure 3-6) contains the following options:

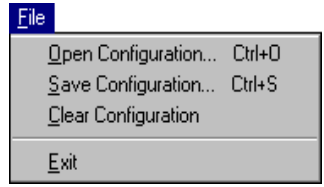


Figure 3-6. File Menu

- **Open Configuration (Ctrl+O)**: Loads a configuration from disk and saves it to the controller. (See “Loading a Configuration from Disk” on page 4-37.)
- **Save Configuration (Ctrl+S)**: Saves a configuration file to a new filename, disk, and/or directory.
- **Clear Configuration**: Removes configuration information for the selected controller.

  ⚠ ***Caution***

  Although there are confirmation checkpoints and warnings following selection of this option, remember that all existing configuration and file data (on all drives connected to the controller) will be deleted.

- **Exit**: Exits the SANArray Manager Client.

View Menu

The View menu (Figure 3-7) contains the following options:

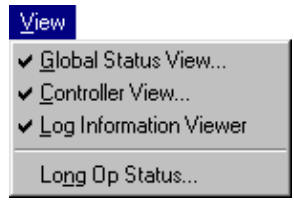


Figure 3-7. View Menu

- **Global Status View**: Toggles the Global Status View window. The Global Status View window opens by default when SANArray Manager Client starts.
- **Controller View**: Toggles the Controller View window showing channel/ID/target information and physical device/logical drive configurations for the controller selected in the controller selection box.
- **Log Information Viewer**: Toggles the Log Information Viewer, a window showing a log of recent system error and status event messages. The Log Information Viewer opens by default when SANArray Manager Client starts.
- **Long Op Status**: Displays the progress (percent complete) of an ongoing full initialization, consistency check, rebuild, and capacity expansion of one or more drives.

Administration Menu

The Administration menu (Figure 3-8) contains the following options:

- **Sign On**: Enables use of SANArray Manager's configuration and administration functions to "Administrators" ("gamroot" + password). Enables only monitoring functions to "Users."
- **Define Server Groups**: Sets up server groups and individual server names or IP addresses within each group.
- **RAID Assist**: Mylex's built-in RAID Controller configuration utility. Facilitates configuration tasks using either one-step "automatic" configuration, a configuration "wizard" assistant, or a manual (advanced-level) configuration option allowing more control over configuration parameters.

Figure 3-8. Administration Menu

- **Initialize Logical Drives**: Offers the ability to run a full initialization of logical drives at a time of your choice, not just immediately following a new configuration. If it is inconvenient to follow a configuration immediately with a logical drive initialization, you can decline the initialization and use this menu item to start the process at a later time.
- **Controller Information**: Displays key information about the currently-selected controller.
- **Enclosure Information**: Displays SES and SAF-TE Enclosure Management information for Mylex Fibre Channel Controllers.
- **Controller Options**: Sets various parameters for the selected Disk Array Controller. Unlike Controller Information, user definable controller parameters are modified in Controller Options.
- **Intelligent BBU**: *(Only enabled if the selected controller has an Intelligent Battery Backup Unit installed.)* Displays a dialog box from which you can do the following:
  - monitor the power remaining in the Intelligent BBU
  - request reconditioning of the Intelligent BBU
  - set the low power threshold

  The Intelligent BBU's features and functionality are described in "Battery Backup Unit Monitoring and Maintenance" on page 5-22.

SANArray Manager simply offers a way of keeping up-to-date as to the condition and charge in the battery.

- **Scan Devices**: Scans for new devices that have recently been added and which are not currently identified within SANArray Manager Client.
- **Advanced Functions**: Opens a submenu (Figure 3-9) from which you can select the following options:
  - **Flash Utility**: Provides the ability to upgrade controller firmware as new maintenance releases become available.
  - **Shutdown**: Enables clean shutdown of the controller system, leaving the battery charged. This feature does not actually shut down the controller system.
  - **Enclosure Discovery**: Starts the SES monitoring process for a new Enclosure. Only performed if an SES device is present or an SES process is running.
  - **Retrieve Debug Dump**: Retrieves an unread debug dump from the controller and saves the information to a file

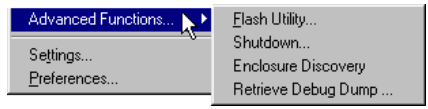


Figure 3-9. Advanced Functions Submenu

- **Settings**: Opens a tabbed dialog box in which you can specify the Event Logging settings that you desire. Examples of such settings include append to log file, replace a log file, enable event logging, event log file name. Event notifications are managed here using the Launch Application feature.
- **Preferences**: Provides the ability to enable several configuration features such as spanning, mixing drive sizes, auto configurator, adding hot spares, and searching for SANmapping groups. Preferences also allows the ability to set the Data and Event ports as well as the Event Log view size.

Window Menu

The Window menu (Figure 3-10) is a standard feature of Windows 95/98, Windows 2000, Windows NT, and Windows XP. It is implemented as such in SANArray Manager.

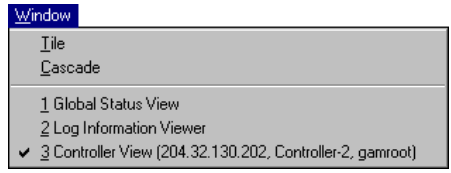


Figure 3-10. Window Menu

Help Menu

The Help menu (Figure 3-11) identifies the on-line help options available within the SANArray Manager Client.

- **Contents**: Displays a list of available help topics.
- **About SANArray Manager**: Displays the Windows standard "About" box.

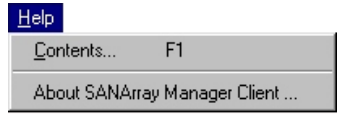


Figure 3-11. Help Menu

Toolbar and Toolbar Icons

SANArray Manager Client contains a toolbar (Figure 3-12) in the SANArray Manager window.

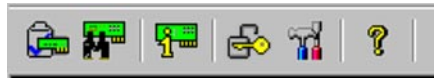


Figure 3-12. Toolbar

Each toolbar button corresponds to a function available from the menu bar.

Disk Configuration Wizard: Brings up the RAID Assist dialog box for RAID controller configuration.

Scan Devices: Scans for new, recently added devices which are not yet identified within SANArray Manager.

Displays Controller Information: Displays key information about the currently-selected RAID Controller.

Sign-On: Enables configuration and administration functions to Administrators and monitoring functions to “Users.”

Settings for Events: Opens a dialog box for specifying Event Editor and Alarm settings.

Help Contents: Displays the on-line help contents page.

Exiting SANArray Manager Client

Exit SANArray Manager Client as shown in Figure 3-13:

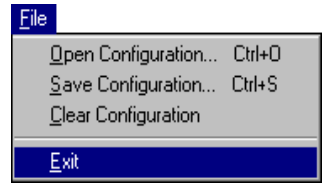


Figure 3-13. Select "Exit"

☛ **Note**

We recommend leaving the SANArray Manager Client running as long as there are servers you wish to monitor or configure. If you do exit, you will be unable to receive events from GAM Server and you will not be informed of errors or status unless you restart SANArray Manager Client.

Exiting GAM Server

Refer to the GAM Server manual for Software Kit 5 for details on how to exit GAM Server.

Setting Up Server Groups and Servers

This section describes how to set up connections to server groups and servers.

Adding a Server Group to the Server Group List

Open Define Server Groups as shown in Figure 3-14. (This is not necessary if you are starting SANArray Manager and no Server Groups are defined. The Define Server Groups dialog box will display automatically.)

Figure 3-14. Select "Define Server Groups"

In the Define Server Groups dialog box (Figure 3-15), do the following:

1. Click the Add button under the Server Groups section of the dialog box.

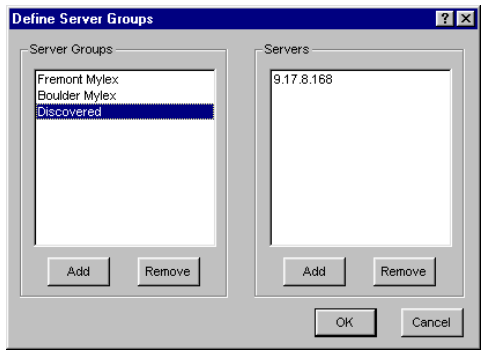


Figure 3-15. Define Server Groups Dialog Box

2. In the Adding Item dialog box, type the name of the server group that you are adding. Naming a server group is a way of identifying a site or collection of related server computers. For example, names like PayRoll or Eastern Sales can be used.
3. Click OK or press the Enter key. The Define Server Groups dialog box will reappear with the newly-defined server group added.

> ☛ **Note**
>
> The Discovered group contains a list of all server hosts that are sending events to the client.

Adding a Server to the Server Groups List

With the Define Server Groups dialog box open (Figure 3-15), do the following:

1. Click the Add button under the Servers section of the dialog box.
2. In the Adding Item dialog box, type the IP address of the server that you are adding. If you're running SANArray Manager Client under Linux, Windows 2000, Windows NT, Windows Me, or Windows XP, you may instead type the *name* of the server.
3. Click OK or press the Enter key. The Define Server Groups dialog box will reappear with the newly-defined server added.
4. To add more servers to the group, repeat steps 1 through 3.
5. Click OK or press the Enter key in the Define Server Groups dialog box when you are finished.

After adding servers, SANArray Manager returns to the Global Status window.

> ☛ **Note**
>
> Select "All Servers" to see all servers in the Global Status view.

Signing On to a Server

This section describes the different server access levels and the methods of signing onto the SAM Client.

Security Access Levels

The ability to perform certain actions within the SAM Client depends on your security access level. There are three levels of security access, Guest (no sign-on), User, and Administrator.

> ☛ **Note**
>
> Do not confuse SAM's Administrator access level with the Windows' log on name "Administrator," they are not the same. The password "gamroot" is required to be established as a user on the server host. It is recommended that the "gamroot" user be established with Windows' "Administrator" privileges or Linux's root privileges. The "gamroot" account must be password protected and the password must be managed in a security conscious manner. SAM relies on the server host's operating system security measures. Therefore, proper handling of the "gamroot" password is critical to the protection of user data on the controller.

Guest

Guest access level is achieved by not signing on to a server host. Guests can monitor the Log Information Viewer and the Global Status View and can manipulate the menu bar controls to determine what is shown in the Global Status View. Guests can change the Administration/Preferences and use Administration/Define Server Groups. Guests cannot view or make changes to any controller parameters or configurations.

User

User access level is achieved by signing on to a server host using a username that is not "gamroot," but one that the administrator of that server assigns. Users have all the capabilities of Guests. Users can also view the detailed status of a controller by activating the Controller View, Controller

Information and Enclosure Information. Users cannot view or make changes to any controller parameters or configurations.

Administrator

Administrator access level is achieved by signing on to a server host using the username "gamroot"; use of a password is highly recommended. **A password is mandatory if the server is running Windows XP.** Administrators have the capabilities of Guests and Users plus the full privilege to view and change the status and settings of the selected controller and other internal SAM settings.

Signing On

To gain access to capabilities beyond Guest access level, you must sign on to a server host.

Double-click a host icon in the Global Status View (Controller View must be closed first).

- The Sign On dialog opens if you have never signed on during this session or if you did not check the Sign On dialog's "Remember password" box on the previous sign on (see Figure 3-16).
- If you have previously signed on and did check the "Remember password" box then, the previously entered username and password will automatically be used for this new sign on.

Figure 3-16. Sign On Dialog Box

If the sign on fails, the Sign On dialog will open to allow adjustment of the username and/or password or you may open Sign On at any time as shown in Figure 3-17.

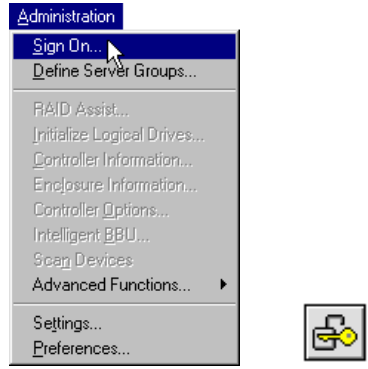


Figure 3-17. Select "Sign On"

Sign on proceeds as follows:

1. The username and password are encrypted and sent to the GAM Server running on the selected server host.
2. The GAM Server receives and decrypts the username and password and makes an operating system specific call to validate them per the server host's operating system's user accounts.
3. After the username and password are validated by the operating system the username is compared to the string "gamroot". If the username matches, sign on is granted Administrator access level.
4. The GAM Server notifies SAM Client of the success or failure of the sign on attempt and whether or not that sign on attempt has been granted Administrator access level.

Do the following to sign on to a server:

1. Type a username and password of your choice that are previously enabled on the server host.

   This will provide access privileges appropriate for the username.
2. Check the box labeled "Remember password for this session" if you want SAM to refrain from Sign On messages each time you select a server during this session which uses the same password. This amounts to an automatic sign-on to additional servers and should be used with caution.

Uncheck the box if you want to retain the option of signing on to each server you wish to access individually.

3. Click the Sign-On button (see Figure 3-16).

Event Settings

Open Settings by clicking **Administration->Settings** on the menu bar or the Settings icon as shown in Figure 3-18.

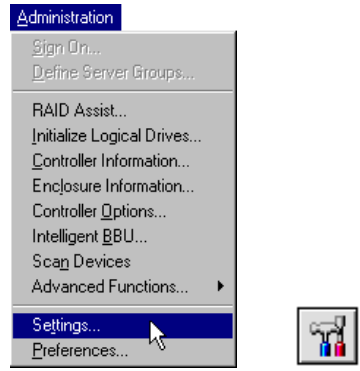


Figure 3-18. Select "Settings"

☛ **Note**

After these settings are selected, it is not necessary to be logged on to SAM client in order to receive event notifications or launch applications; SAM client must; however, be running.

Event Logging

Event Logging provides you options for setting desired event logging capabilities.

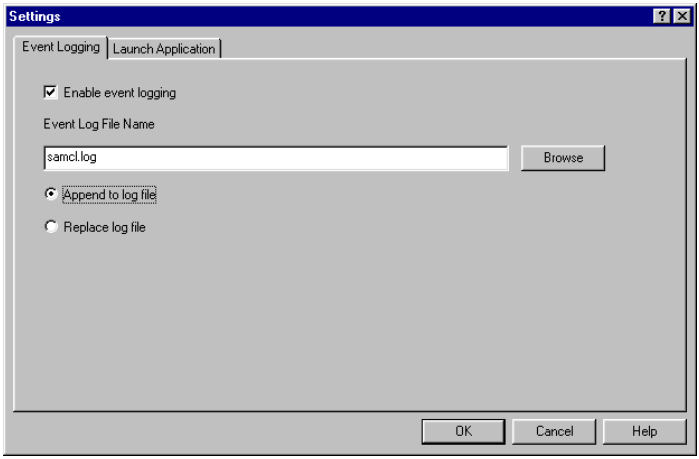


Figure 3-19. Settings Dialog Box – Event Logging

In the Settings dialog box, under the Event Logging tab (Figure 3-19), you have several options:

- Enable or disable the event logging to a file function
- Specify the path and name of the event log file
- Append events to your current log file when SAM starts, or
- Replace the log file (overwrite it) when SAM starts

Launch an Application

1. Select the Launch Application tab in the Settings dialog box (Figure 3-20).

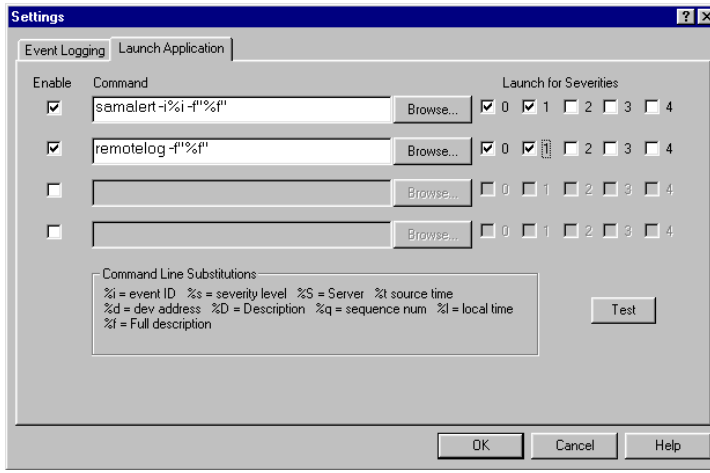


Figure 3-20. Launch Application Alarm Setup

2. In the Launch Application box:
   - Enable or disable each Command field using the Enable check box as desired.
   - In the Command field, type the name of an application to launch. If you don't remember the name or path of the application, click the Browse button. The Command Line Substitutions pane shows various format specifiers and their meanings. Place these format specifiers in the Command field as command line options as desired, and when an event occurs, SAM will replace the format specifiers with the indicated portion of the event data. Depending on the underlying operating system or shell, it may be necessary to quote some portions of the command line. Note that some of the replacements will result in multiple words separated by whitespace to appear on the command line.
   - Check the Launch for Severities checkbox(es) that corresponds to the event severity level(s) at which you would like to launch each

application. For example, in Figure 3-20, all level 0 and level 1 events will result in a launch application.

3. To test the application launch using the settings you've input, click Test. This will result in all the enabled Launches being made with the command line substitution text taken from the Command Line Substitutions pane. This is an aid in setting up the Launch Application system.
4. When you are satisfied with the application you've set up, click OK or press the Enter key.

Modifying Preferences

Open Preferences by clicking **Administration->Preferences** on the menu bar as shown in Figure 3-18.

Figure 3-21. Select "Administration->Preferences"

The Preferences dialog box opens (Figure 3-22).

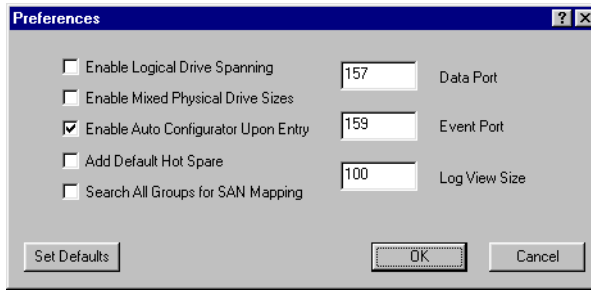


Figure 3-22. Preferences Dialog Box

Set any of the following Preferences:

- **Logical Drive Spanning**. Enable for Logical Drive Spanning. Note that when a logical drive is spanned across arrays, those arrays cannot be expanded.
- **Mixed Physical Drive Sizes**. When enabled, allows you to use all of the configurable capacity of the physical drives composing an array. This means that after common capacity sizes have been consumed, irregular capacities may be configured into additional logical drives.

  ☛ **Note**

  Using this feature increases the potential of configuring a non-redundant logical drive on an array which will preclude rebuilding the array when a physical drive fails.

- **Auto Configurator Upon Entry**. When enabled and when opening the Controller View in SAM if unused drives are detected, a dialog box opens asking if you want to let SAM configure the system for you.
- **Add Default Hot Spare**. When enabled, a default hot spare will be added to any configuration made if there is a drive on the controller that is not part of the new configuration.
- **Search All Groups for SANmapping**. This check box is only effective if you are running firmware version 6.x or higher. When enabled, all servers in all server groups will be searched to resolve WWNs to hostnames when entering SANmapping in RAID Assist.

When disabled, only the servers in the currently selected server group will be searched. Disabled is the recommended setting.

- **Data Port**. Allows you to select and change the Data port, the valid range is 0 to 65535.

  ☛ **Note**

  If the Event or Data ports are changed, the user is warned that changing these variables may have adverse effects on the connectivity between the SAM Client and all servers running GAM Server.

- **Event Port**. Allows you to select and change the Event port, the valid range is 0 to 65535.
- **Log View Size**. Allows you to control the number of lines (events) that are available in the Log Information Viewer. This is the number of recent events that the user may view. All events are available in the event log file if event logging is enabled.
- **Set Defaults**. Returns all values to default.

For More Information...

This concludes the Startup & Navigation chapter. For additional information on SANArray Manager options and functionality, refer to other chapters in this installation guide, and to the context-sensitive online help file available from the Help menu, by pressing **F1**, or by right-mouse-clicking an item on which you require help.

Chapter 4
Configuration

Introduction

Configuration activities involve the following:

- Setting or modifying controller options to suit your application needs
- Modifying physical device options for data transfer or tag value
- Creating, modifying, or deleting Mylex RAID Controller configurations
- SANmapping
- Spanning
- Loading and saving a configuration

Setting and Modifying Controller Options

Open Controller Options as shown in Figure 4-1.

Figure 4-1. Select "Controller Options"

Basic Controller Options

In the Basic Controller Options dialog box (Figure 4-2), you have several options.

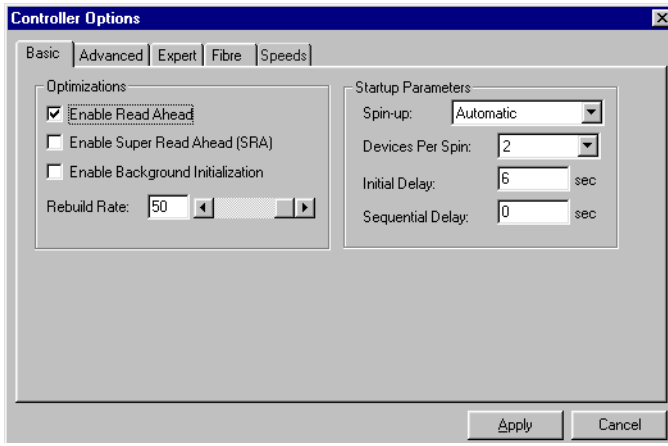


Figure 4-2. Basic Controller Options Dialog Box

Enable or disable (by checking or unchecking) any of the following Global Parameters:

- **Read Ahead**. When enabled, reads data to the next stripe boundary (based on stripe size) and retains in cache any data beyond the size of the actual read request.
- **Super Read Ahead (SRA)**. When enabled, extends the Read Ahead process by always reading an extra cache line on a read request, and reading an additional cache line when a cache hit occurs. Most useful for applications where read-sequential data is high.
- **Background Initialization**. When enabled, allows a logical drive to be initialized as a background operation while reads and writes are being performed.
- **Rebuild Rate**. A rate of 50 assigns the maximum allowable resources to a drive rebuild or array expansion, allowing the Rebuild or Expand to proceed at its fastest. Lowering the number devotes more resources to I/Os and consequently slows the Rebuild or Expand Array process. This parameter takes effect immediately without resetting the controller(s).

Change any of the following Startup Parameters:

- **Spin-up**. Change if you do not want automatic drive spin-up. The other option is to spin up at power on.
- **Devices Between Spins**. Number of devices to spin up at one time. A low number lessens the likelihood of a power drain.
- **Initial Delay**. Number of seconds to wait before spinning up the first disk set.
- **Sequential Delay**. Number of seconds between consecutive device spin-up cycles.

Advanced Controller Options

In the Advanced Controller options dialog box (Figure 4-3), you have several options.

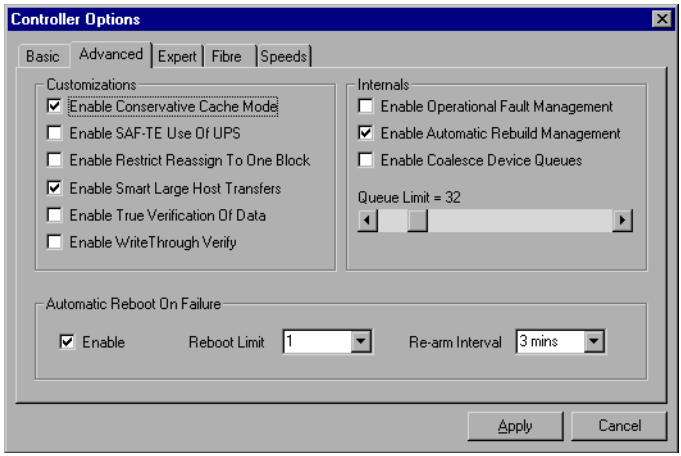


Figure 4-3. Advanced Controller Options Dialog Box

Set the following Customizations. Enable or disable (by checking or unchecking):

- **Conservative Cache Mode**. Turns off write cache while a controller failover condition persists, allowing an extra degree of data safety.
- **SAF-TE Use of UPS**. Enables monitoring of uninterruptable power supply if it is also supported by the system enclosure.
- **Restrict Reassign to One Block**. Restricts a reassign to the failing block. If disabled, reassigns will be for the entire current I/O blocks, not all of them failing.
- **Smart Large Host Transfers**. When enabled, allows selection of Coalesce (fewer disconnects on large transfers) on host data transfers. When disabled, allows As Available (more disconnects) on host data transfers. The Smart Large Host Transfers function takes effect for transfers larger than the stripe size. This parameter takes effect immediately, without resetting the controllers.

- **True Verification Of Data**. Verifies accuracy of the data with data comparison.
- **Write Through Verify**. During error handling, this turns on Force Unit Access for reads and writes.

Set the following internal options:

- **Operational Fault Management**. Allows the controller to take autonomous actions when a failure occurs.

  WARNING

  Do not disable this function unless specifically instructed to do so as part of a troubleshooting diagnostic activity.

- **Automatic Rebuild Management**. Works in conjunction with SAF-TE disk array enclosures to detect removal of a failed drive and perform an automatic rebuild after installation of a replacement drive.
- **Coalesce Device Queues**. Joins data from adjacent I/Os into a single I/O to improve performance.
- **Queue Limit**. Maximum allowed queue depth for tagged commands to each attached drive. Settings are from 1 (no tags) to 230.

Set the following Automatic Reboot on Failure Options:

- **Enable**. Enables the Reboot On Failure feature.
- **Reboot Limit**. Sets a limit of how many times a controller will attempt to automatically reboot to recover from firmware detected errors. Settings are from 0 to 15.
- **Re-arm Interval**. Allows a minimum number of times that the controller must run before automatically re-arming itself with a new set of automatic reboots. Select a time interval from the drop-down list.

Expert Controller Options

In the Expert Controller options dialog box (Figure 4-4), you have several options.

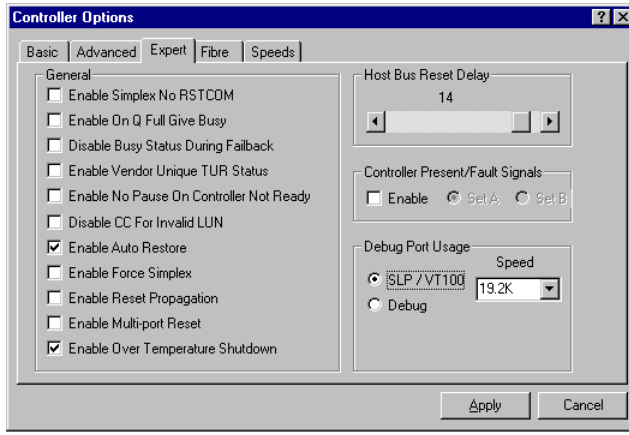


Figure 4-4. Expert Controller Options Dialog Box

Set any of the following Expert options. Enable or disable (by checking or unchecking):

- **Simplex No RSTCOM**. When enabled, allows a controller not to assert a reset signal to its partner controller. Simplex environments only.
- **On Q Full Give Busy**. When enabled, if a command is received and the controller detects a full queue, it will return a "busy" status rather than Queue Full. This helps hosts that do not accurately deal with Queue Full status.
- **Busy Status During Failback**. When enabled, causes all pending commands to be quietly dropped during failback. This is intended to help hosts that are confused by Queue Full.
- **Vendor Unique TUR (Test Unit Ready) Status**. When enabled, allows a vendor unique TUR effect. A TUR sent to an offline LUN will get a hard error status returned.
- **No Pause On Controller Not Ready**. When enabled, if the controller is not fully started, certain commands encounter a pause.

This turns off the pause.

- **CC For Invalid LUN**. When enabled, disables the check condition, affecting the handling of the Inquiry command when the referenced LUN is invalid.
- **Auto Restore**. Default is Disabled. When enabled in a dual-active controller system, Automatic Restore allows automatic recovery of a partner controller when a replacement is inserted. If you enable this option, you must also enable the Controller Present/Fault Signals option.
- **Force Simplex**. When enabled, allows duplex firmware to work in a simplex environment by skipping some Active-Active operations.
- **Reset Propagation**. When enabled, a reset detected by one port may be propagated out of the other ports including ports on the partner controller.
- **Multi-port Reset**. When enabled, allows execution of an internal reset on a port only if a logical drive has been reserved through that port.
- **Over Temperature Shutdown**. When enabled, if an over-temperature condition develops, the physical disks are spun down and the affected controller is taken off line. Power to the controllers must then be cycled to return to normal operations. Temperature thresholds that define over-temperature and under-temperature conditions for each enclosure can be set on the Enclosure Information display (refer to “Settings Page” on page 5-17).
- **Host Bus Reset Delay**. Allows the controller to reset the host in failover and failback situations. When *Disabled* – no SCSI bus reset is generated on the host; *1–14* – generates reset this many seconds after the failover or failback occurs; *Immediate* – generates immediate reset with no delay. This is for host SCSI only.
- **Controller Present/Fault Signals**. Default is Enabled. Enables the use of backplane signals for sensing the presence of, or possible fault in, the partner controller in a dual-active controller configuration. If you have enabled Auto Restore, enable this function also. This parameter is necessary for hot plugging controllers and automatic failback.

- Set **Debug Port Usage**. Select SLP/VT100 emulation or Debug mode.
- Set **Debug Port Speed**. Sets the baud rate for the serial port from 2400 to 19200 baud. Speeds are available as supported by the selected controller.

Fibre Controller Options

In the Fibre Controller options dialog box (Figure 4-5), you have several options.

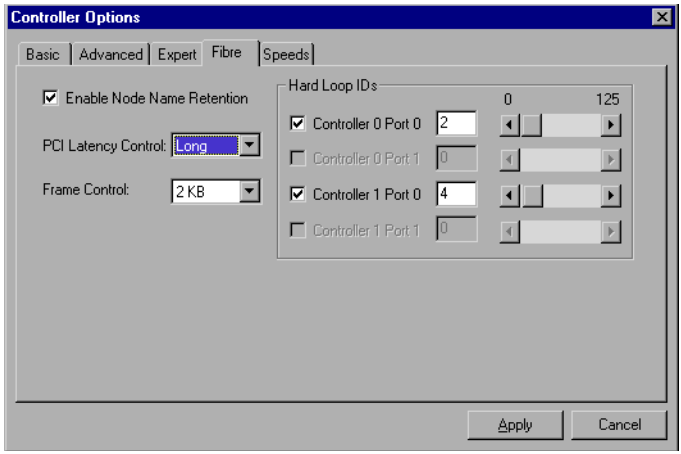


Figure 4-5. Fibre Controller Options Dialog Box

Set any of the following Fibre options:

- **Node Name Retention**. When enabled, each controller shares its node name with its partner controller, and those names are used through all phases of failover and failback.
- **PCI Latency Control**. Controls the amount of data each host port Fibre Protocol Processor can burst across the primary PCI bus before relinquishing bus ownership. Settings are Short, Medium, Long. A setting of Long is recommended.
- **Frame Control**. Allows adjustment of the FC chip's frame size.
- **Hard Loop IDs**. Enables hard loop IDs on a controller. If the requested

ID is not available, an available loop ID number will be automatically assigned. Some Fibre HBAs work better with this.

Speed Controller Options

The Speed Controller Option is only available if you are using a 2Gbps capable fibre controller. In the Speed Controller options dialog box (Figure 4-5), you have several options.

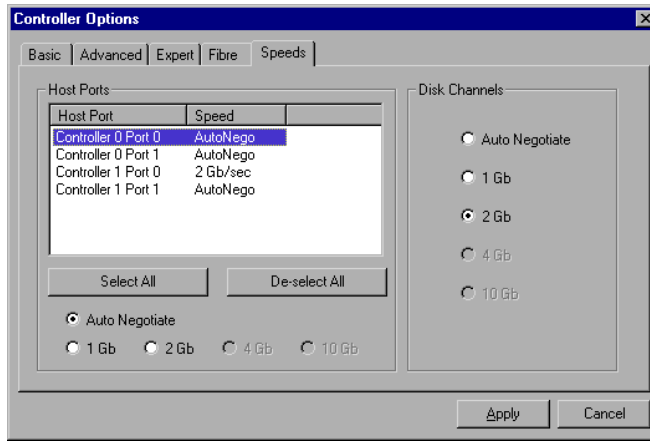


Figure 4-6. Speed Controller Options Dialog Box

Set any of the following Host Ports options:

- **Host Ports**. Lists all of the host ports on the selected server. One or more host ports may be selected simultaneously for making Speed changes. Once a selection is made from the Host Ports list, the Auto Negotiate, 1Gbps, and 2Gbps radio buttons are enabled.
- **Select All**. Selects all listed host ports as recipients of the changes made with the Apply button.
- **De-select All**. De-selects all host ports and causes all speed radio buttons to be disabled until at least one host port is selected.
- **Auto Negotiate**. Sets an Auto Negotiate speed for the host port(s) selected.

- **1 Gbps**. Sets a 1 Gigabits per second speed for the host port(s) selected.
- **2 Gbps**. Sets a 2 Gigabits per second speed for the host port(s) selected.

> ☛ **Note**
>
> Only supported speeds are enabled.

Set any of the following Disk Channels options:

- **Auto Negotiate**. Sets an Auto Negotiate speed for all the backend disk channels.
- **1 Gbps**. Sets a 1 Gigabits per second speed for all the backend disk channels.
- **2 Gbps**. Sets a 2 Gigabits per second speed for all the backend disk channels.

> ☛ **Note**
>
> Only supported speeds are enabled.

Recording Your Changes

Click the Apply button or press the Enter key to accept all of the changes in the Basic, Advanced, Expert, Fibre and Speed Controller Options dialog boxes, or the Cancel button to discard them.

Running RAID Assist

RAID Assist is the SANArray Manager Client's "wizard" for the setup and configuration of new logical drives and disk arrays.

In its simplest form, RAID Assist provides an *Auto Configuration* option which immediately configures all available drives into an optimal, configuration. RAID Assist's *Assisted Configuration* sets up a new array according to predefined parameters, and asks the user questions to gather key information necessary to build the array.

If configuration needs go beyond what Auto or Assisted Configuration offer, the *Manual Configuration* option allows full control of all elements of the configuration process including SANmapping.

Entering RAID Assist

Open RAID Assist by clicking **Administration->RAID Assist** on the menu bar or the RAID Assist icon as shown in Figure 4-7.

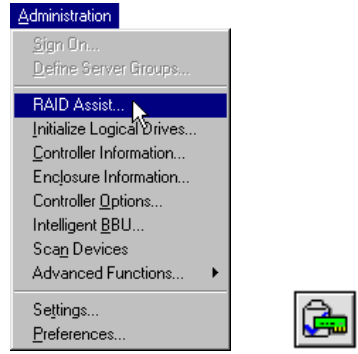


Figure 4-7. Select "RAID Assist"

The RAID Assist "Welcome" dialog box displays (Figure 4-8).

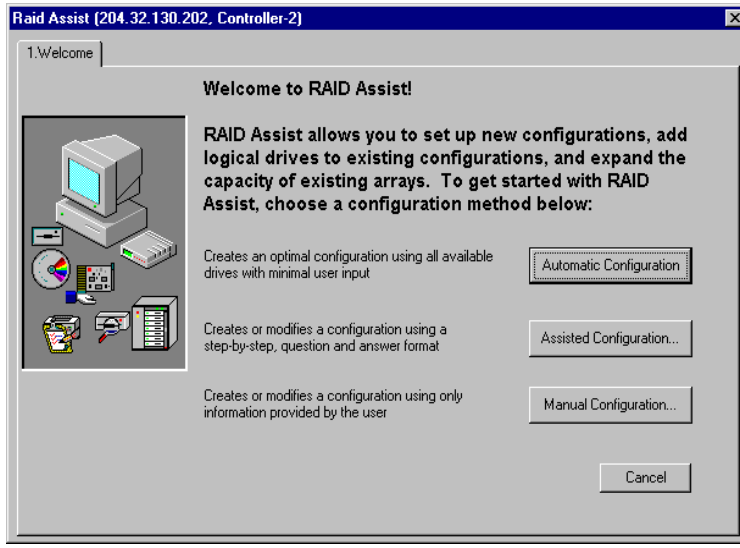

Raid Assist (204.32.130.202, Controller-2)
1.Welcome
Welcome to RAID Assist!
RAID Assist allows you to set up new configurations, add logical drives to existing configurations, and expand the capacity of existing arrays. To get started with RAID Assist, choose a configuration method below:
Creates an optimal configuration using all available drives with minimal user input
Automatic Configuration
Creates or modifies a configuration using a step-by-step, question and answer format
Assisted Configuration...
Creates or modifies a configuration using only information provided by the user
Manual Configuration...
Cancel

Figure 4-8. RAID Assist "Welcome" Dialog Box

In the RAID Assist "Welcome" dialog box (Figure 4-8), do one of the following:

- Click the *Automatic Configuration* button if you want to provide only minimal input and allow RAID Assist to set up an optimal configuration automatically, or
- Click the *Assisted Configuration* button if you want RAID Assist to lead you step-by-step through the configuration, or
- Click the *Manual Configuration* button if you want full control over your configuration setup, or
- Click Cancel if you want to exit RAID Assist without any changes.

Automatic Configuration

Automatic Configuration provides two options:

- **New Configuration**. Sets up a new configuration on the controller, deleting the previous configuration and data (if any).
- **Add Logical Drive**. Sets up additional arrays (logical drives) leaving the existing array(s) intact. At least one array must be configured on this controller, and unconfigured capacity must exist.

For example, open New Configuration as shown in Figure 4-9.

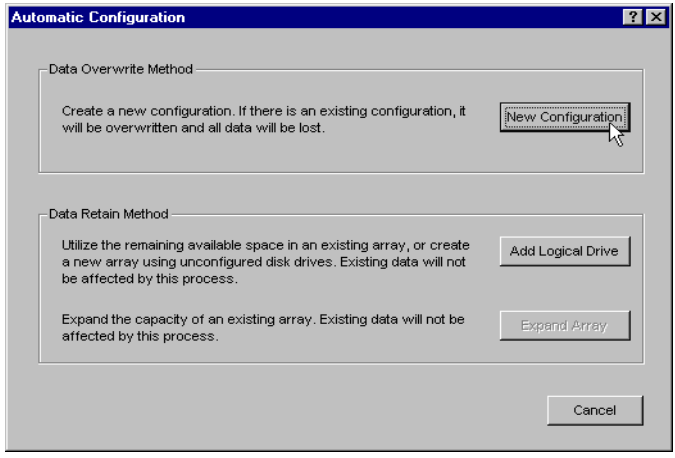

Automatic Configuration
Data Overwrite Method
Create a new configuration. If there is an existing configuration, it will be overwritten and all data will be lost.
New Configuration
Data Retain Method
Utilize the remaining available space in an existing array, or create a new array using unconfigured disk drives. Existing data will not be affected by this process.
Add Logical Drive
Expand the capacity of an existing array. Existing data will not be affected by this process.
Expand Array
Cancel

Figure 4-9. Select "New Configuration"

The New Configuration option of the Automatic Configuration feature provides the administrator with the option of customizing the automatic configuration. The automatic configuration feature uses the maximum number of drives, provides a fault tolerant RAID level when able, and creates a hot spare drive for drive failure protection. The number of logical drives created is dependent on the total number of physical drives discovered.

The Finish screen displays (Figure 4-10).

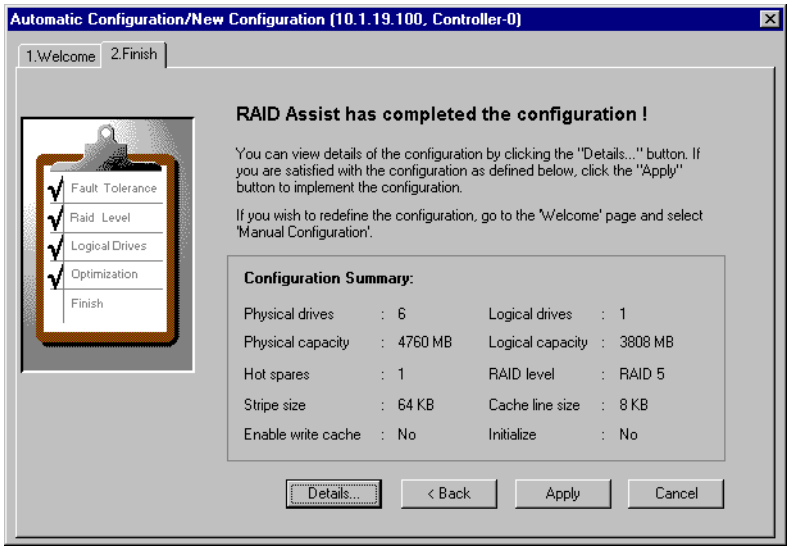

Automatic Configuration/New Configuration (10.1.19.100, Controller-0)
1.Welcome
2.Finish
Fault Tolerance
Raid Level
Logical Drives
Optimization
Finish
RAID Assist has completed the configuration !
You can view details of the configuration by clicking the "Details..." button. If you are satisfied with the configuration as defined below, click the "Apply" button to implement the configuration.
If you wish to redefine the configuration, go to the 'Welcome' page and select 'Manual Configuration'.
Configuration Summary:
Physical drives : 6
Logical drives : 1
Physical capacity : 4760 MB
Logical capacity : 3808 MB
Hot spares : 1
RAID level : RAID 5
Stripe size : 64 KB
Cache line size : 8 KB
Enable write cache : No
Initialize : No
Details...
< Back
Apply
Cancel

Figure 4-10. Automatic Configuration->New Configuration->Finish

Do the following:

1. Examine the Configuration Summary for details about the configuration that RAID Assist will set up.
2. If you want to start over, click the Back or Cancel button, or the Welcome tab, OR

   If you want to view the configuration before it is applied to the controller, click the Details button. You will be taken to an equivalent of the Disk Arrays page as shown in Manual Configuration, except that you can only view and close the details window.

3. If you accept the configuration as presented, click the Apply button or press the Enter key at the Finish page to apply the new configuration to the controller.

   A warning confirmation box appears as shown in Figure 4-11.

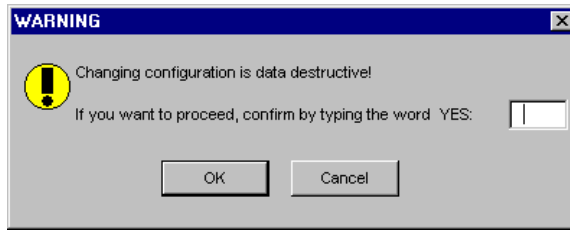


Figure 4-11. WARNING Before Applying the Configuration

4. Type YES and click OK or press the Enter key if you are sure you want to apply the new configuration and overwrite the old. If you're not sure, click Cancel.

> ☛ **Note**
>
> In Automatic Configuration, Add Logical Drive and Expand Array function very similarly to the New Configuration option. In each case, RAID Assist prepares an optimal configuration without user input based on characteristics of the available devices.

Assisted Configuration

Assisted Configuration provides two options:

- **New Configuration**. Sets up a new configuration on the controller, deleting the previous configuration and data (if any).
- **Add Logical Drive**. Sets up additional arrays (logical drives) leaving the existing array(s) intact. At least one array must be configured on this controller, and unconfigured capacity must exist.

For example, open New Configuration as shown in Figure 4-12:

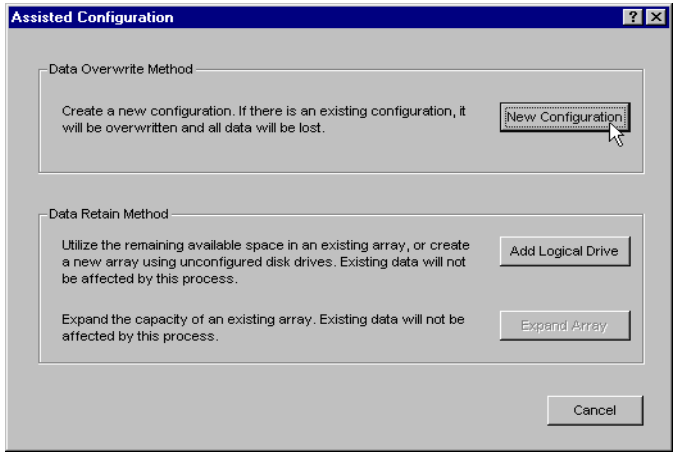

Assisted Configuration
Data Overwrite Method
Create a new configuration. If there is an existing configuration, it will be overwritten and all data will be lost.
New Configuration
Data Retain Method
Utilize the remaining available space in an existing array, or create a new array using unconfigured disk drives. Existing data will not be affected by this process.
Add Logical Drive
Expand the capacity of an existing array. Existing data will not be affected by this process.
Expand Array
Cancel

Figure 4-12. Select "New Configuration"

Assisted Configuration walks you step by step through a new configuration (Figure 4-13). Each "tab" in the Assisted Configuration dialog box collects information about an important aspect of the configuration you wish to set up. During this process, you provide answers to several questions.

Fault Tolerance Tab

Configure the following options (Figure 4-13) for fault tolerance.

1. Do you want Fault Tolerance? [Yes/No]
2. Do you want a Hot Spare? [Yes/No]

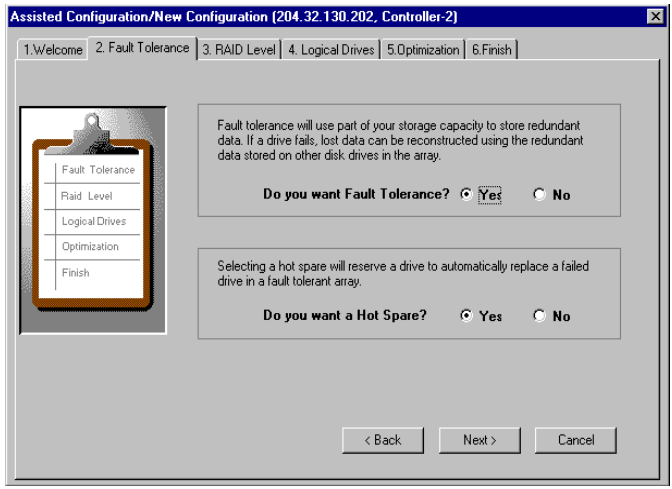

Assisted Configuration/New Configuration (204.32.130.202, Controller-2)
1.Welcome
2. Fault Tolerance
3. RAID Level
4. Logical Drives
5.Optimization
6.Finish
Fault Tolerance
Raid Level
Logical Drives
Optimization
Finish
Fault tolerance will use part of your storage capacity to store redundant data. If a drive fails, lost data can be reconstructed using the redundant data stored on other disk drives in the array.
Do you want Fault Tolerance?
Yes
No
Selecting a hot spare will reserve a drive to automatically replace a failed drive in a fault tolerant array.
Do you want a Hot Spare?
Yes
No
< Back
Next >
Cancel

Figure 4-13. Assisted Configuration – Fault Tolerance

RAID level tab if fault tolerance was yes (Figure 4-14), choose between:

- Parity error correction (RAID 5, RAID 3), or
- Fully redundant drives (RAID 1, RAID 0+1)

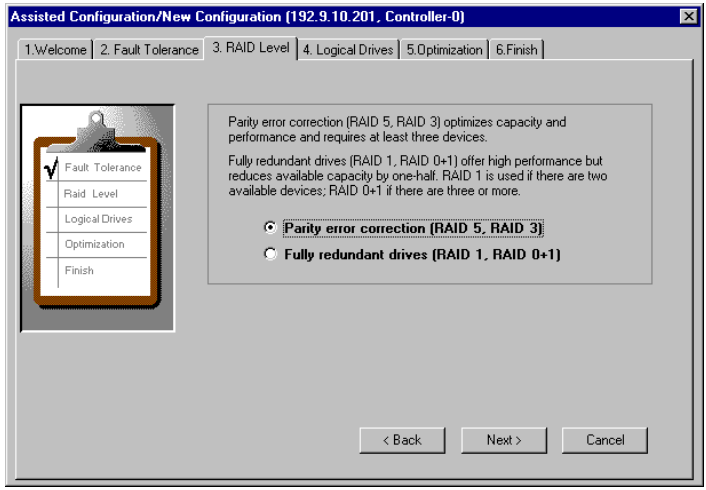

Assisted Configuration/New Configuration (192.9.10.201, Controller-0)
1.Welcome
2. Fault Tolerance
3. RAID Level
4. Logical Drives
5.Optimization
6.Finish
Fault Tolerance
Raid Level
Logical Drives
Optimization
Finish
Parity error correction (RAID 5, RAID 3) optimizes capacity and performance and requires at least three devices.
Fully redundant drives (RAID 1, RAID 0+1) offer high performance but reduces available capacity by one-half. RAID 1 is used if there are two available devices; RAID 0+1 if there are three or more.
Parity error correction (RAID 5, RAID 3)
Fully redundant drives (RAID 1, RAID 0+1)
< Back
Next >
Cancel

Figure 4-14. Assisted Configuration – RAID Level With Fault Tolerance

RAID level tab if fault tolerance was no (Figure 4-15), choose between:

- Striping (RAID 0), or
- Stand-alone drive (JBOD)

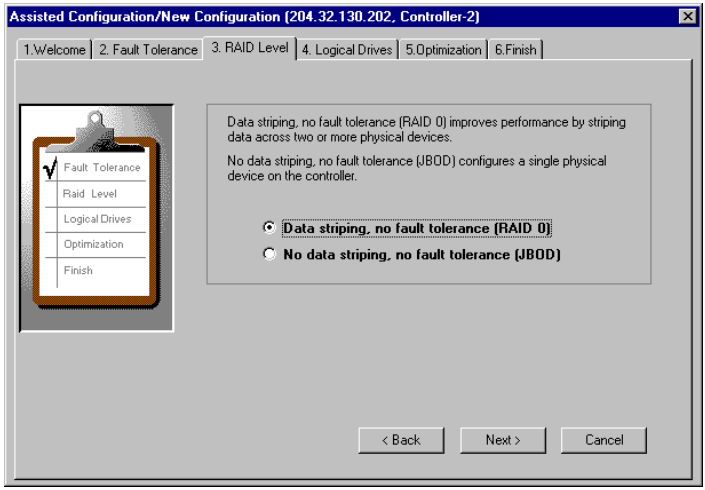

Assisted Configuration/New Configuration (204.32.130.202, Controller-2)
1.Welcome
2. Fault Tolerance
3. RAID Level
4. Logical Drives
5.Optimization
6.Finish
Fault Tolerance
Raid Level
Logical Drives
Optimization
Finish
Data striping, no fault tolerance (RAID 0) improves performance by striping data across two or more physical devices.
No data striping, no fault tolerance (JBOD) configures a single physical device on the controller.
Data striping, no fault tolerance (RAID 0)
No data striping, no fault tolerance (JBOD)
< Back
Next >
Cancel

Figure 4-15. Assisted Configuration – RAID Level With No Fault Tolerance

Logical Drives Tab

Configure the following options (Figure 4-16) for a logical drive.

1. How many logical drives do you want to create? [1–32]
2. How much capacity do you want to use? [default=100% available space, or equivalent in MB]
3. Do you want to initialize logical drives? [Yes/No]

   This is a Foreground initialization done after the configuration has been applied. Do not select this option if you have enabled and require Background Initialization. Certain controllers allow Immediate RAID Availability of logical drives after configuration. For these controllers, initialization can take place in the background without the need to wait for full foreground initialization.

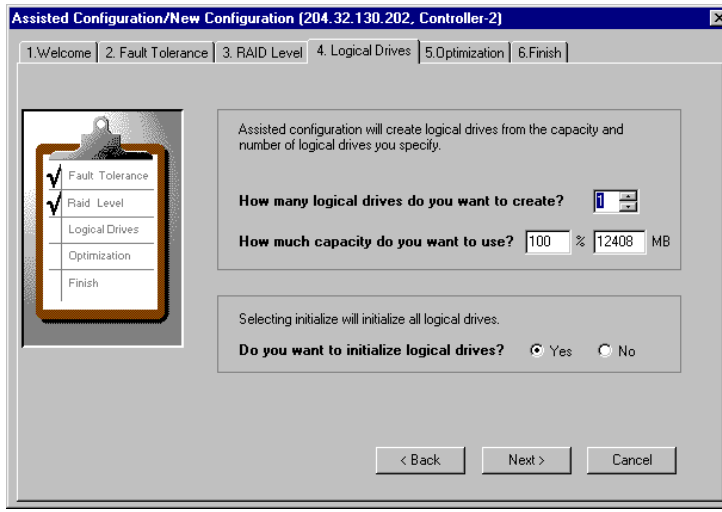


Figure 4-16. Assisted Configuration – Logical Drives

Optimization Tab

Configure the following options (Figure 4-17) for optimization.

1. Choose between:
   - write cache enabled (write back), or
   - write cache disabled (write through)
2. Select Stripe Size (valid options are in the list).
3. Cache line size not supported.

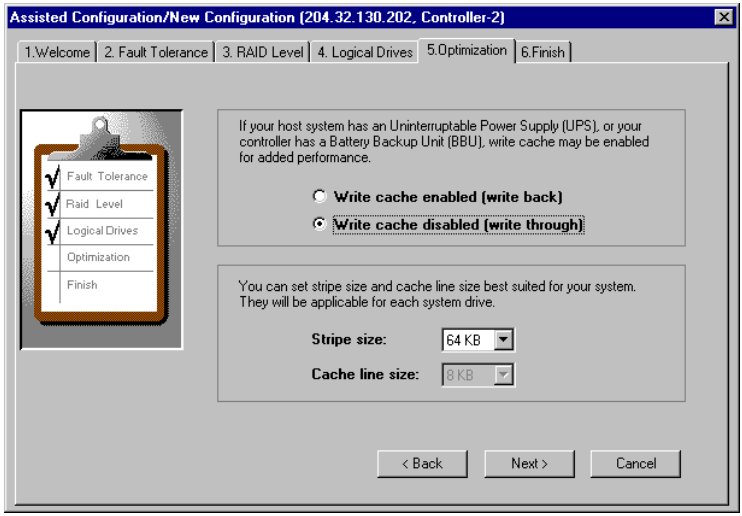

Assisted Configuration/New Configuration (204.32.130.202, Controller-2)
1.Welcome
2. Fault Tolerance
3. RAID Level
4. Logical Drives
5.Optimization
6.Finish
Fault Tolerance
Raid Level
Logical Drives
Optimization
Finish
If your host system has an Uninterruptable Power Supply (UPS), or your controller has a Battery Backup Unit (BBU), write cache may be enabled for added performance.
Write cache enabled (write back)
Write cache disabled (write through)
You can set stripe size and cache line size best suited for your system. They will be applicable for each system drive.
Stripe size:
64 KB
Cache line size:
8 KB
< Back
Next >
Cancel

Figure 4-17. Assisted Configuration – Optimization

Finish Tab

When you get to the Finish screen (Figure 4-18), do the following:

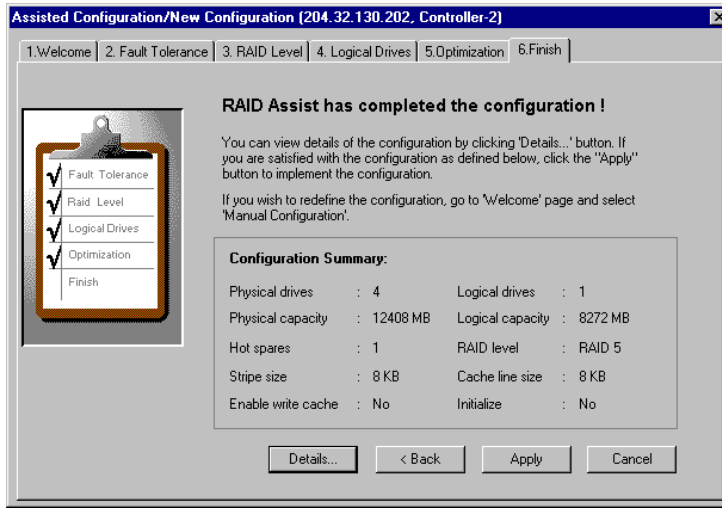

Assisted Configuration/New Configuration (204.32.130.202, Controller-2)
1.Welcome
2. Fault Tolerance
3. RAID Level
4. Logical Drives
5.Optimization
6.Finish
Fault Tolerance
Raid Level
Logical Drives
Optimization
Finish
RAID Assist has completed the configuration !
You can view details of the configuration by clicking 'Details...' button. If you are satisfied with the configuration as defined below, click the "Apply" button to implement the configuration.
If you wish to redefine the configuration, go to 'Welcome' page and select 'Manual Configuration'.
Configuration Summary:
Physical drives : 4
Logical drives : 1
Physical capacity : 12408 MB
Logical capacity : 8272 MB
Hot spares : 1
RAID level : RAID 5
Stripe size : 8 KB
Cache line size : 8 KB
Enable write cache : No
Initialize : No
Details...
< Back
Apply
Cancel

Figure 4-18. Assisted Configuration->New Configuration->Finish

1. Examine the Configuration Summary for details about the configuration that RAID Assist will set up.
2. If you want to start over, click the Welcome tab or Cancel button, OR

   If you want to change your answers to any of the questions you were asked, click the appropriate tab to return to that screen, OR

   If you want to view the configuration before it is applied to the controller, click the Details button. You will be taken to an equivalent of the Disk Arrays page as shown in Manual Configuration, except that you can only view and close the details window.
3. If you accept the configuration as presented, click the Apply button or press the Enter key at the Finish page to apply the new configuration to the controller.

A warning confirmation box opens (see Figure 4-19):

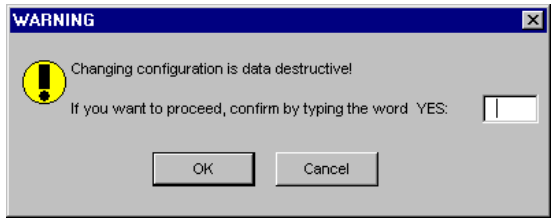


Figure 4-19. WARNING Before Applying the Configuration

4. Type YES and click OK or press the Enter key if you are sure you want to apply the new configuration and overwrite the old. If you're not sure, click Cancel.

> ☛ **Note**
>
> In Assisted Configuration, Add Logical Drive and Expand Array function very similarly to the New Configuration option. In each case RAID Assist leads you step-by-step through the relevant questions for the task.

Manual Configuration

Manual Configuration provides four options:

- **Edit Configuration**. Displays the current configuration (disk arrays and logical drives) and allows you to make any changes that you require.

> ☛ **Note**
>
> Edit Configuration should not be used when you are clearing the entire configuration. To clear a configuration, use the **File->Clear Configuration** menu option.

- **New Configuration**. Sets up a new configuration on the controller, deleting the previous configuration and data (if any).
- **Add Logical Drive**. Sets up additional arrays (logical drives) leaving the existing array(s) intact. At least one array must be configured on this controller, and unconfigured capacity must exist.

- **Expand Array**. Restripes data in your array across additional, unconfigured drives to expand the capacity of the array.

For example, open New Configuration as shown in Figure 4-20.

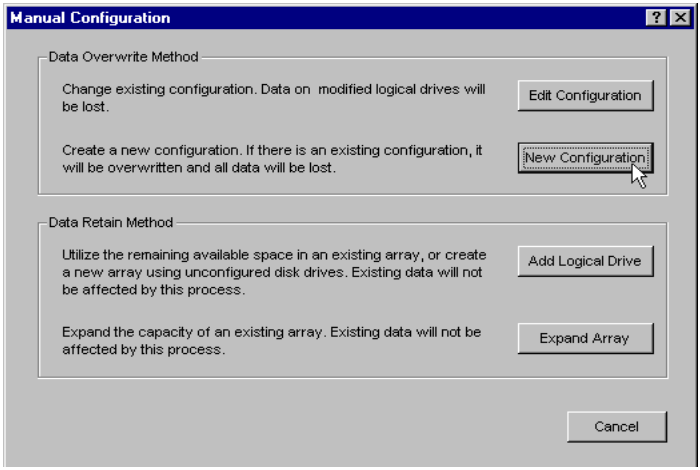

Manual Configuration
Data Overwrite Method
Change existing configuration. Data on modified logical drives will be lost.
Edit Configuration
Create a new configuration. If there is an existing configuration, it will be overwritten and all data will be lost.
New Configuration
Data Retain Method
Utilize the remaining available space in an existing array, or create a new array using unconfigured disk drives. Existing data will not be affected by this process.
Add Logical Drive
Expand the capacity of an existing array. Existing data will not be affected by this process.
Expand Array
Cancel

Figure 4-20. Select "New Configuration"

The Disk Arrays tab in Manual Configuration is where you begin to configure your unused disk drives (lower left, Figure 4-21).

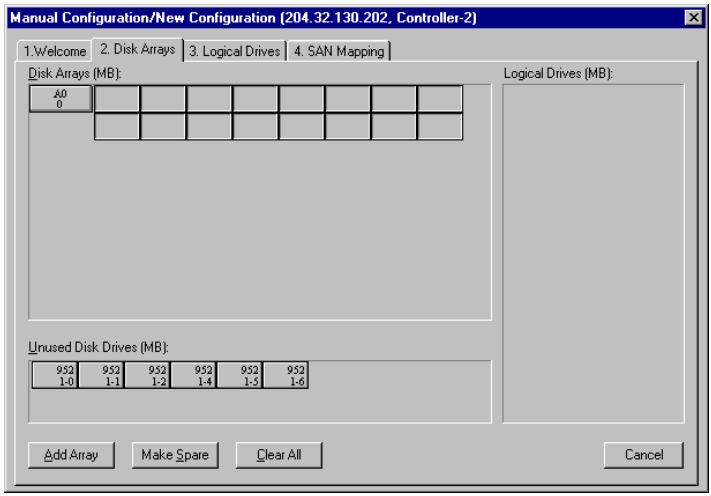


Figure 4-21. Manual Configuration – Disk Arrays

Each disk array is represented by one section in the Disk Arrays area of the screen (upper left, Figure 4-21). Logical drives (if any have already been configured) display on the right side.

Do the following:

1. Select an unused drive and drag it to the Disk Array A0 section. The drive will be part of a disk array referred to as "A0."
2. Select other unused drives and drag them to Disk Array A0, or click the Add Array button to create a row for Disk Array A1 (then A2, A3, etc.), then drag unused drives to A1 if you so desire.

> ☛ **Note**
>
> Multiple drives can be added by holding down Ctrl while clicking drives, then dragging the selected set to a Disk Array section.

3. If you want to manually configure a hot spare, click an unused drive, then click the Make Spare button.
4. If you want to start over, click the Clear All button and start again.

5. Once you have assembled the disk array groups, click the Logical Drives tab to continue on to logical drive setup (Figure 4-22).

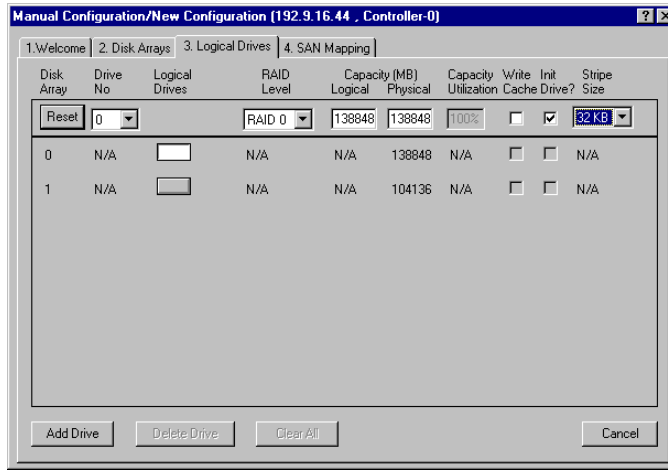


Figure 4-22. Manual Configuration – Logical Drives

The Logical Drives tab in Manual Configuration is where you configure your disk arrays into logical drives.

Do the following:

1. Highlight a drive icon, and select a drive number to be associated with this logical drive.
2. Select a RAID level for this logical drive. Supported RAID levels are RAID 0, RAID 1, RAID 3, RAID 5, RAID 0+1, and stand-alone drive (JBOD). Only RAID levels compatible with the current array will be available in the list.
3. Type the amount of available logical or physical capacity for this logical drive. If your total configuration will have only one logical drive which uses all available capacity, the default sizes should not be changed. If you intend to create additional logical drives now or later, type a smaller number to reserve the desired amount of capacity.

4. Check the Write Cache box if you want this logical drive to use Write Back caching. This improves performance but puts data at risk. You should have a battery backup unit or uninterruptable power supply if selecting this feature.
5. Check the Init Drive box if you want this logical drive to be fully initialized at the conclusion of the configuration. It is recommended that you check this option, unless the controller is capable of background initialization.
6. Select a stripe size. (Available only when defining the first logical drive.)
7. Click the Add Drive button to register your new logical drive. Repeat the process above to set up additional logical drives, then click the SAN Mapping tab when you are done.
8. Click the SAN Mapping tab to continue with configuration (see “SANmapping in SANArray Manager” on page 4-27).

An example of a completed Manual configuration is shown in Figure 4-23.

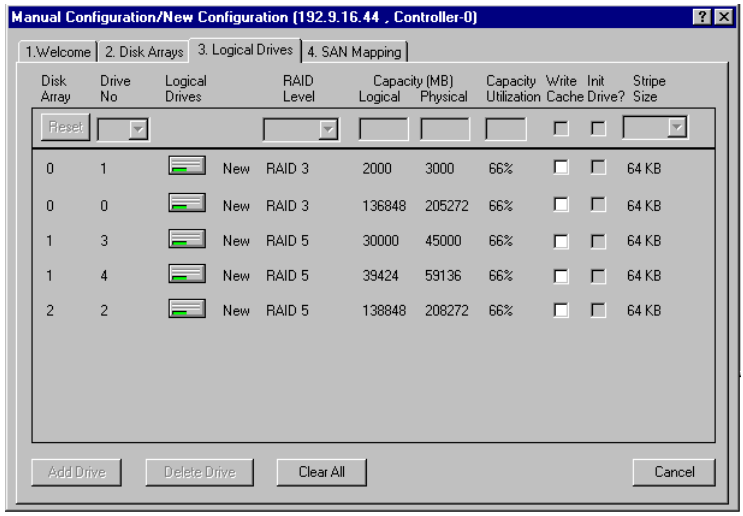


Figure 4-23. Sample Manual Configuration Just Before “Apply”

Note

In Manual Configuration, Add Logical Drive and Expand Array function very similarly to what was shown above. In each of these two cases, however, RAID Assist shows you the disk arrays and logical drives and allows you to add to the configuration without risking existing data.

SANmapping in SANArray Manager

SANArray Manager implements SANmapping by allowing the user to select the topology used by the controller(s), the ports to be used, the Host to Logical Drive Mapping for each logical drive, and the Logical Drive to LUN Mapping for each logical drive. Figure 4-24 shows an example of SANmapping. SANmapping is most useful when the controller system is operating in a multiple host environment. This allows logical drive access to be controlled on a host-by-host basis. Hosts are identified by the World Wide Names (WWNs).

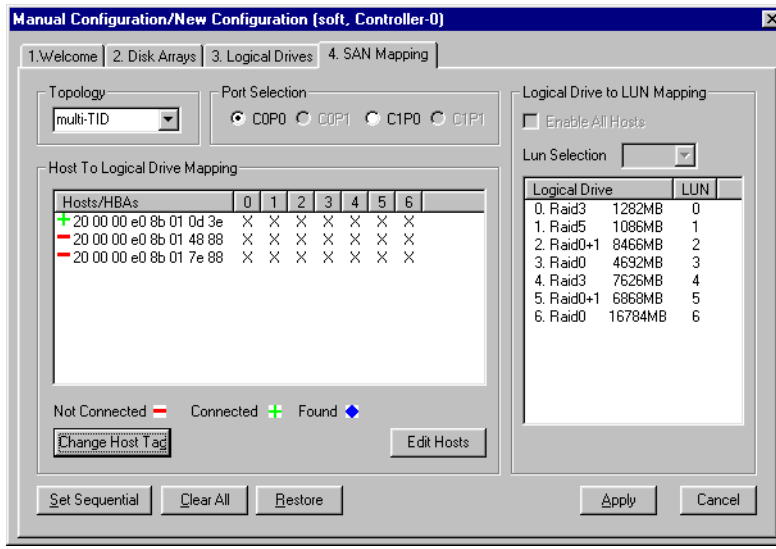


Figure 4-24. A SANmapping Scenario

Selecting the Topology

SANmapping provides the user with two possible dual-active controller configuration topologies:

> ☛ **Note**
>
> Topologies are available as supported by the selected controller.

- **MultiPort**. All ports are active. This topology does not provide transparent failover/failback and requires an alternate path driver in the host.
- **Multi-TID**. All ports are active. This topology is supported on all Fibre products with ISP2200 and ISP2300 hardware. This topology provides transparent failover/failback and should not be used in conjunction with an alternate path driver.

Selecting the Port

Host ports are made selectable based on the controller type and selected topology. Some ports may therefore be unavailable for selection.The host to logical drive list and logical drive to LUN list are displayed for the selected port.

Logical Drive to LUN Mapping

Logical Drive to LUN Mapping associates a logical drive defined in the configuration with a LUN. The Logical Drive to LUN mapping pane lists the logical drive (LD#, RAID level, and size) and LUN assignment. If no LUN is associated with the logical drive, the LUN field is blank. However, it is required that at minimum, a LUN 0 be defined in order for the controller to connect.

When a logical drive is selected, the LUN Selection field and the Enable All Hosts check box become active. If a LUN assignment exists for the logical drive, it is displayed in the LUN Selection field. The LUN Selection drop-down box displays all valid LUNs that may be assigned to the selected logical drive.

Enable All Hosts allows a logical drive LUN assignment that is enabled for all hosts on the loop. This allows all hosts on the loop access to the logical drive through the LUN without having to redefine the mapping as new hosts

are added to the loop. Enable All Hosts mapping is the default mapping for all new configurations and old configurations that are converted to new configurations.

> ☛ **Note**
>
> Enable All Hosts can generate an error if another logical drive is sharing a LUN with the logical drive being enabled and hosts have been assigned to the logical drive. In this situation, the operation is not allowed.

Host to Logical Drive Mapping

Host to logical drive mapping associates hosts on the fibre channel loop to logical drives. The hosts are displayed on the left side of the list including the state of the host and the host's identity, either WWN or IP address (see Figure 4-25).

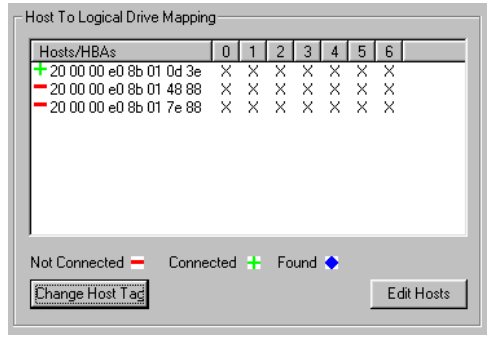


Figure 4-25. Host to Logical Drive Mapping Identity

The host identity is the WWN (World Wide Name) of the Host Bus Adapter (HBA) of a server on the fibre channel loop. An attempt is made to find the servers. Servers with multiple HBAs have an ordinal number in parentheses after the name/IP address identifying the HBA. HBAs will only show "Found" if the server with the HBA is running GAM Server and is accessible on the network. See "Modifying Preferences" on page 3-24 for a control on the server search.

The Change Host Tag button allows you to change the format of the name for connected Hosts and HBAs. You may toggle through the name/IP address, WWN, and host bus target LUN of the HBA.

The Edit Hosts button opens a dialog box that allows you to make changes to the WWN table (see Figure 4-26).

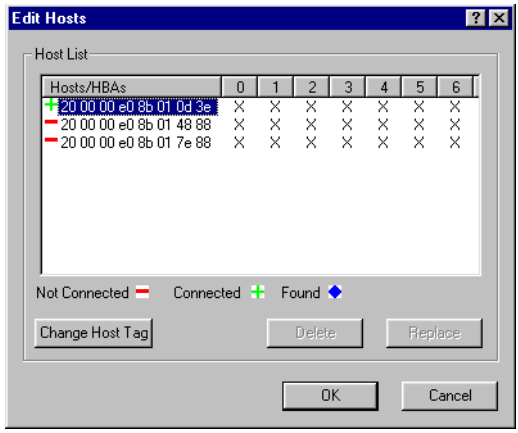


Figure 4-26. Edit Hosts Dialog Box

The following Edit Hosts options are available:

- The **Change Host Tag** button only applies to found hosts, not connected hosts. This feature allows you to change the format of the name for found hosts and HBAs. You may toggle through the name/IP address, WWN, and host bus tag list of the HBA.
- The **Delete** button allows deletion of the highlighted host(s) from the World Wide Name Table. Only hosts that are not connected are eligible for deletion.
- The **Replace** button will copy the LUN map of the highlighted unconnected host to the highlighted attached host. The highlighted unconnected host in the World Wide Name Table will be deleted. Only a single unconnected host can be highlighted and only a single connected host can be highlighted for this button to be enabled.
- The **OK** button applies the settings made.

- The **Cancel** button cancels the settings made.

The host states are defined as follows:

Found: The host is logged on and found. The IP address or host name is displayed. A server may have more than one.

Connected: The host is logged on to the fibre channel loop. The host cannot be found on the IP network. The WWN of the host HBA is displayed on the network.

Not Connected: This is a host that is not logged on to the loop.

Available hosts on the network are determined by the client running an internal algorithm.

☛ **Note**

See “Modifying Preferences” on page 3-24 for a setting that affects finding hosts.

Each row in the table identifies a host and each column identifies a logical drive. An ‘X’ in the table connects a host with a logical drive. A ‘-’ means the host is not mapped. The mappings are toggled by left clicking the mouse on the entry. As entries change in the Host to Logical Drive Mapping list, the Logical Drive to LUN Mapping information is updated.

The following rules are enforced:

- Logical drives may share LUNs as long as the same host does not access both logical drives.
- The host to logical drive mapping can be made before assigning a LUN to the logical drive. A LUN assignment can be made at any time. Only valid LUN assignments are displayed in the LUN selection field.
- Host to logical drive mapping may be done without assigning any hosts. Hosts may be assigned at any time.

Set Sequential

The Set Sequential button sets all logical drives to LUN assignments sequentially and all host to logical drive mapping to Enable All Hosts. For example, logical drive 0 to LUN 0, logical drive 1 to LUN 1, etc.

Clear All

The Clear All button sets all LUN assignments to None. You can then select individual assignments more closely while allowing several assignments of "inaccessible." A dialog box will open if an apply attempt is made with no assignments.

Restore

The Restore button resets the SANmapping configuration to the mapping assigned at the time RAID Assist is entered. If editing an existing configuration, the original mapping is read from the firmware. A new configuration reverts to the default mapping, Enable All Hosts.

Cancel

The Cancel button cancels the *entire configuration*, including what was set up under the Disk Arrays, Logical Drives, and SAN Mapping tabs. If you want to cancel only your SANmapping changes, use the Restore button.

Apply

The Apply button applies the entire controller configuration, including what was set up under the Disk Arrays, Logical Drives, and SAN Mapping tabs.

Click Apply or press the Enter key when you are ready to accept the entire controller configuration you've specified across all Manual Configuration tabs.

Spanning in SANArray Manager Client

Spanning provides the ability to configure multiple disk arrays or parts of multiple disk arrays as one logical drive. This means that space is used from the first array to the last array. All of the arrays used for spanning must be identical in the number and size of the physical drives composing the arrays.

Enable Spanning in SAM

To enable Spanning in SAM, use the following procedure:

1. Open Preferences by clicking **Administration->Preferences** on the menu bar.
2. Click the Enable Logical Drive Spanning check box to enable spanning. Spanning may be enabled and disabled as desired during the various disk configuration efforts. It is not necessary to leave it enabled once a spanned array has been created. It is not necessary that spanning be disabled to create a non-spanned array.

Configuring a Spanned Array

1. Within SAM, select **Administration->RAID Assist**.

Figure 4-27. Select "RAID Assist"

2. Select the Manual Configuration button , then New Configuration to begin to configure a spanned disk array (Figure 4-28).

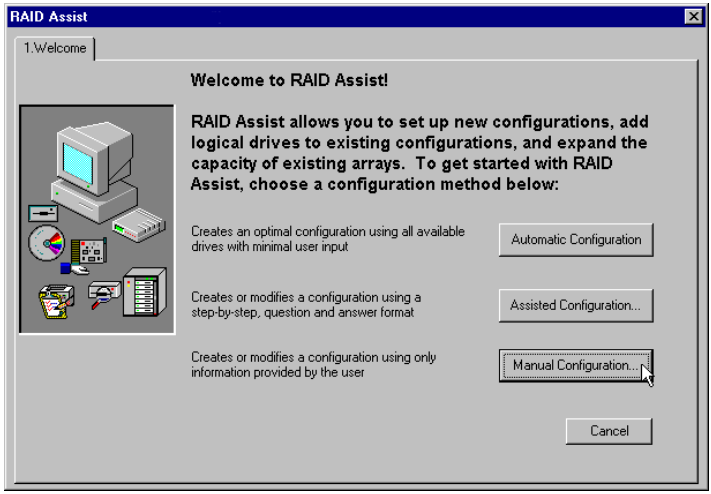

RAID Assist
1.Welcome
Welcome to RAID Assist!
RAID Assist allows you to set up new configurations, add logical drives to existing configurations, and expand the capacity of existing arrays. To get started with RAID Assist, choose a configuration method below:
Creates an optimal configuration using all available drives with minimal user input
Automatic Configuration
Creates or modifies a configuration using a step-by-step, question and answer format
Assisted Configuration...
Creates or modifies a configuration using only information provided by the user
Manual Configuration...
Cancel

Figure 4-28. Select "Manual Configuration"

☛ **Note**

Automatic and Assisted configuration options do not allow spanning.

Creating a Spanned Disk Array

1. Click the Disk Arrays tab.
2. Drag and drop the available disk drives from the Unused Disk Drives (MB) section to the existing disk array (A0).

   ☛ **Note**

   Multiple drives can be moved by holding down Ctrl while clicking drives, then dragging the selected set to a Disk Array.

3. Continue to define disk arrays by clicking Add Array and then moving the available disk drives to each array (A1, A2, and so on).

   ☛ **Note**

   Remember to use the same number of devices in each array; otherwise spanning cannot be utilized.

Figure 4-29 shows the creation of four arrays each having three disk drives.

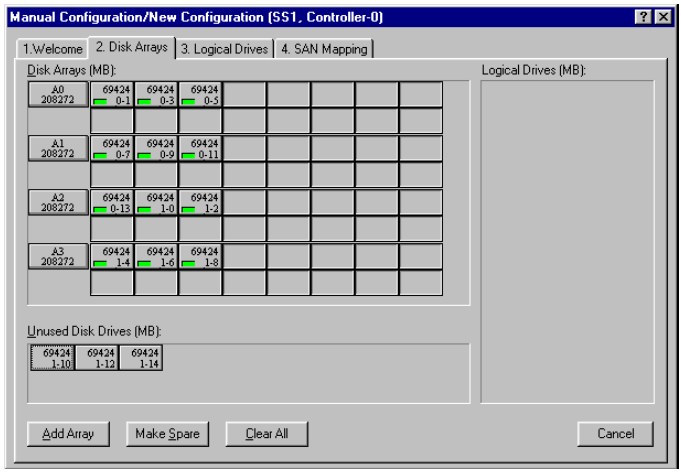


Figure 4-29. Creating a Spanned Array

☛ **Note**

In order to utilize spanning you **must** configure a logical drive that exceeds the capacity of one of the disk arrays you configured in step 3.

4. Select the Logical Drives tab. Configure one or more logical drives. (Refer to page 25 for information on how to configure logical drives.)

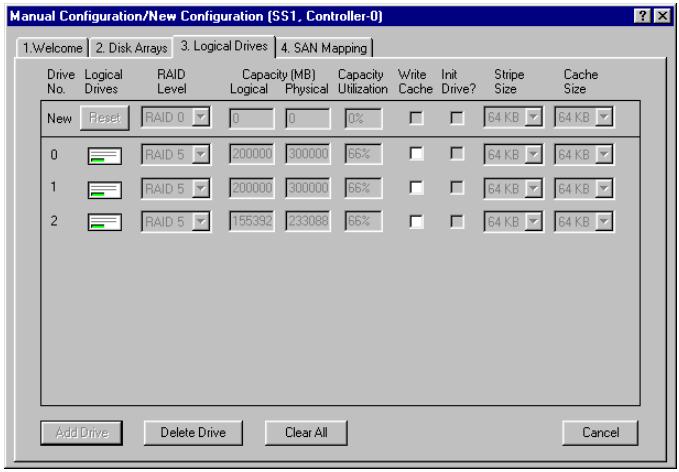


Figure 4-30. Spanned Array

5. Continue with the configuration as described in “Manual Configuration” on page 4-22.

Loading a Configuration from Disk

Load a previously-saved configuration from disk as shown in Figure 4-31.

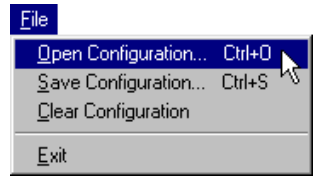


Figure 4-31. Select "Open Configuration"

1. In the Open Configuration dialog box (Figure 4-32), select the configuration file you wish to open to save to the controller.

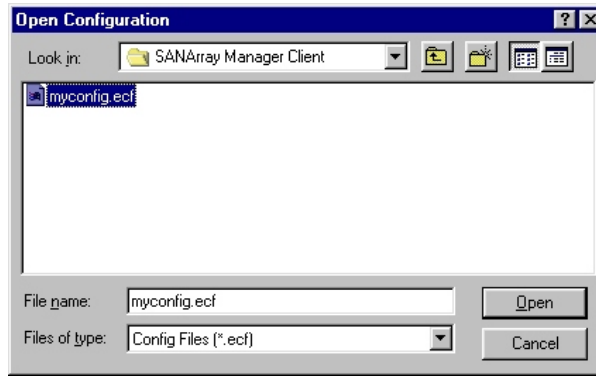


Figure 4-32. Open Configuration Dialog Box

2. Click Open to access the configuration file.

   Changing the configuration is data destructive. A warning message appears (Figure 4-33):

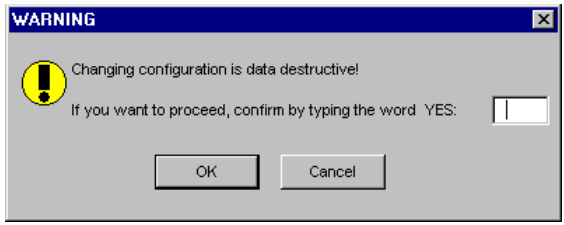


Figure 4-33. Open Configuration Warning Message

3. To confirm your decision to overwrite the existing configuration, type YES then click OK or press the Enter key, or

   Click Cancel to stop without applying the saved configuration.

Saving a Configuration to Disk

Saves a configuration file to a new filename, disk, and/or directory.

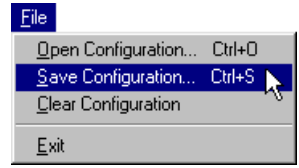


Figure 4-34. Select "Save Configuration"

1. In the Save Configuration dialog box (Figure 4-32), type a name for the configuration file you wish to save.

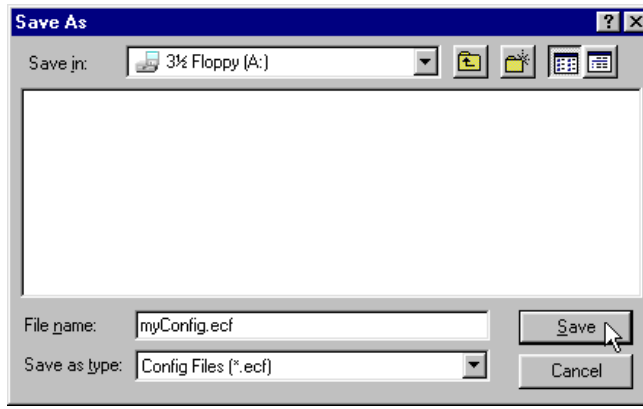


Figure 4-35. Save Configuration Dialog Box

2. Click Save to save the configuration file. The configuration file (.ecf) as well as a text file (.txt) with configuration information will be saved.

Chapter 5
Monitoring

Introduction

Monitoring activities involve the following:

- Monitoring events (messages) sent by various servers to the client workstation(s).
- Monitoring controller activity, reviewing controller configuration and other information.
- Reviewing physical device and logical drive information, and locating arrays.
- Monitoring and managing SAF-TE and SES enclosure information.
- Monitoring the status of ongoing processes, such as initialization, rebuild, consistency check, and expanding capacity of an array.
- Monitoring the status of an Intelligent Battery Backup Unit (BBU), and recharging/reconditioning the battery if needed.

Event Monitoring

GAM Server monitors activity of all devices and controllers attached to the server. When a controller firmware generated event occurs (whether severe, such as a hard disk failure, or informational, such as assignment of a drive to hot spare status), GAM server retrieves those events and forwards them to SAM Client.

Events are displayed in the Log Information Viewer. An “event” can be any of the following:

- Error or warning condition in a RAID subsystem (such as a power, fan, or drive failure)
- Any administrative activity (taking a drive off-line, killing, or rebuilding a drive)

> ☛ **Note**
>
> It is recommended that the SANArray Manager Client be kept continuously active.

Opening the Log Information Viewer

The Log Information Viewer is opened when SAM Client is started and at least one controller is detected (see “Components of the Log Information Viewer” on page 3-5). The viewer displays the contents of samcl.log, an ASCII text file. This file contains a detailed chronological log of all the events that occur while this session of the program is executing.

Opening an Event Information Window

If you wish to obtain additional information about any event displayed in the Log Information Viewer, the program allows you to open an event information window. Appendix A documents the entire list of events, descriptions, possible causes, and actions.

To open the event information window for a particular event:

1. Check that the Log Information Viewer is displayed.
2. Determine which event you would like more information about (scroll the Log Information Viewer if necessary), and double-click anywhere along the event line (or double-click in the Event ID field).

An event information window for your selected event is displayed. An example is shown in Figure 5-1.

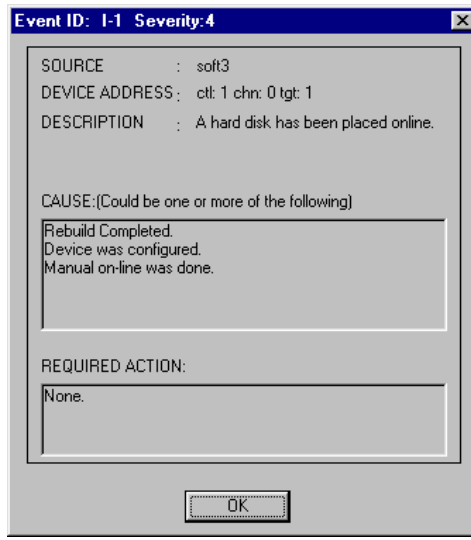

Event ID: I-1 Severity:4
SOURCE : soft3
DEVICE ADDRESS : ctl: 1 chn: 0 tgt: 1
DESCRIPTION : A hard disk has been placed online.
CAUSE:(Could be one or more of the following)
Rebuild Completed.
Device was configured.
Manual on-line was done.
REQUIRED ACTION:
None.
OK

Figure 5-1. Event Information Window

A variety of information about the event is displayed to aid in troubleshooting. The Event ID and Severity Level are displayed in the window's titlebar. SOURCE, DEVICE ADDRESS, and DESCRIPTION redisplay information from the original event line.

The most useful fields are:

- **CAUSE**. Possible reasons that the event occurred, and
- **REQUIRED ACTION**. What you should do in response to this message. Informational messages will most likely have no required actions. Critical, Serious, Error, and Warning messages may specify useful required actions.

3. Click OK or press the Enter key to close the event information window.

Controller Monitoring

After a client and server connection is made through sign-on, the SANArray Manager Client opens the Controller View window for the selected controller (see “Components of the Controller View Window” on page 3-6 for a detailed description).

Displaying Controller Information

Open Controller Information by clicking **Administration->Controller Information** on the menu bar or the Controller Information icon as shown in Figure 5-2.

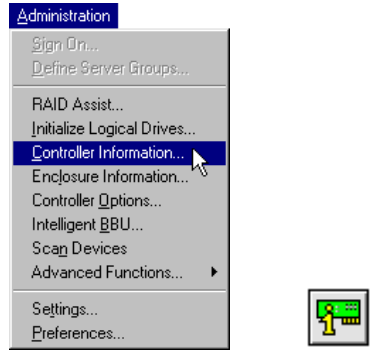


Figure 5-2. Select “Controller Information”

The Controller Information window opens (see Figure 5-3).

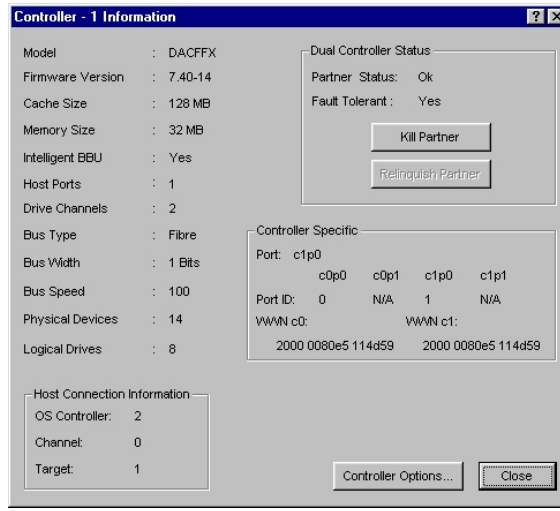


Figure 5-3. Controller Information

The following information is displayed:

- The controller model
- The firmware version residing on the controller
- The cache size
- The memory size
- Whether an Intelligent Battery Backup Unit is installed (N/A for not supported on the current controller)
- The number of host ports on this controller
- The number of drive channels on the controller
- The host port bus type (SCSI, Fibre Channel) of the controller
- The host port bus width (for data transfers) and bus speed (MB/sec)
- The number of physical devices detected
- The number of logical drives configured on this controller
- Host Connection Information: HBA number, channel ID and target ID

- The status of a partner controller in a dual-active pair
- Whether the controller is set up to operate as part of a dual-active (fault tolerant) pair
- The port number, port ID, and World Wide Name (if any) of this specific controller and its partner controller

Click the Kill Partner button to cause this controller's partner controller to be placed in reset. The controller must be in dual-active for this to happen.

Click the Relinquish Partner button to cause this controller's partner controller to return to an operating state after a kill.

Click the Controller Options button to view a dialog box of user-definable controller parameters.

Click the Close button or press the Enter key to close the Controller Information window.

Physical Device and Logical Drive Monitoring

This section describes how the SANArray Manager Client monitors physical devices and logical drives.

Displaying Device Information

The Controller View window details which *physical* devices are associated with each controller channel. Each stack of drives represents the physical drives connected to a single channel on the controller.

A physical device can be a host controller, enclosure processor or disk drive. Double-click a physical device icon to display information about a particular physical device.

A physical device icon representing a Fibre Channel controller may not be displayed in the stack of physical devices in the Controller View window. The controller device information is available through the controller information window described on page 5-4.

A physical device icon representing an enclosure processor may not be displayed in the stack of physical devices in the Controller View window. The enclosure information is available through the Enclosure button in

Controller View or the Enclosure Information menu item in the Administration menu.

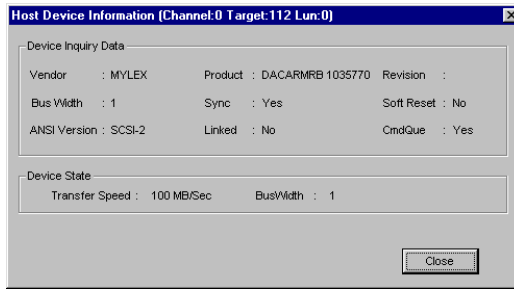


Figure 5-4. Host Device Information – RAID Controller

Device Information (Figure 5-4, Figure 5-5) displays the following about the currently-selected physical device.

Device Information: RAID Controller

- The vendor or source of the controller
- The controller's product identification
- The revision level of the hardware
- The drive channel bus width
- Whether the following parameters are set to Yes or No: Sync, Soft Reset, Linked, Command Queuing
- ANSI Version supported
- Drive channel transfer speed and bus width (device state)

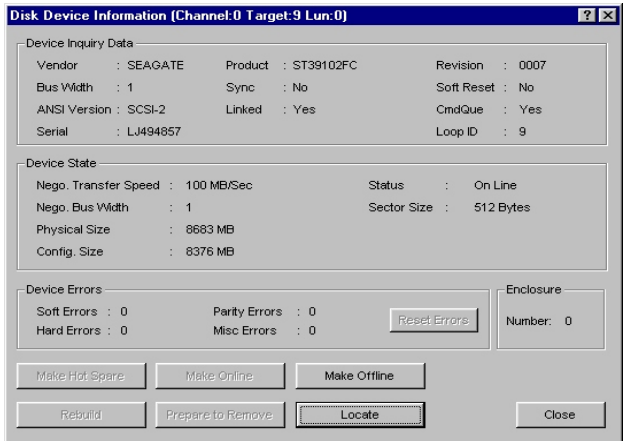


Figure 5-5. Disk Device Information

Device Information: Disk Drive

- The vendor or source of the drive
- The drive's product identification (such as ST39173FC)
- The revision level of the firmware in the drive
- The drive channel bus width (in bits)
- Whether the following parameters are set to Yes or No: Sync, Soft Reset, Linked, Command Queuing
- Loop ID number
- ANSI Version supported
- Disk drive serial number
- The physical capacity of the disk device in MB
- The drive channel negotiated transfer speed (MB/sec) and negotiated bus width
- The "configured" size of the disk device in MB
- Sector size (usually 512 bytes)

- The current status of the disk (online, offline, etc.) and a failure indicator if the disk drive has failed (refer to Appendix A for a list of error codes)
- The number of soft, hard, parity, and miscellaneous errors registered
- The identity of the enclosure where the physical drive resides

In the disk drive Device Information dialog box...

Click the Reset Errors button to return all error tallies to 0.

If the physical device is unconfigured, the Make Hot Spare button may be available to set this device as a hot spare.

If the disk drive's status is Rebuild, the Rebuild button may be available so that you can initiate a physical device rebuild.

☛ **Note**

The rebuild option for dual-active controllers is only available by slot 0. Check the controller information to see which controller is in slot 0.

If the disk drive's status is Dead, you will see a failure indicator display on the Device Information page in the Device State section.

Make Online and Make Offline buttons should be used with great caution. Refer to the online help file, or call Mylex for support on these options.

The Prepare to Remove button causes a specific physical drive to spin down in preparation of removal. The specified physical drive may then be physically removed.

☛ **Note**

The Prepare Drive for Removal feature only supports enclosures equipped with an SES device. In the absence of a working SES device, the request to prepare a drive for removal is rejected by the controller.

The Prepare Drive for Removal option for dual-active controllers is only available by slot 0 when operating in dual active mode. Check the controller information to see which controller is in slot 0. The controller in

slot 0 will be able to perform the Prepare Drive for Removal.

Click the Locate button to “blink” the LED of the physical device to reveal its location. Click OK or press the Enter key to end the locate operation.

In any Device Information dialog box...

Click the Close button or press the Enter key to close the dialog box.

Displaying Logical Drive Information

The icons on the right side of the Controller View window represent the *logical drives* created by configuring the physical drives.

Double-click a logical drive icon to display information about a particular logical drive (Figure 5-6).

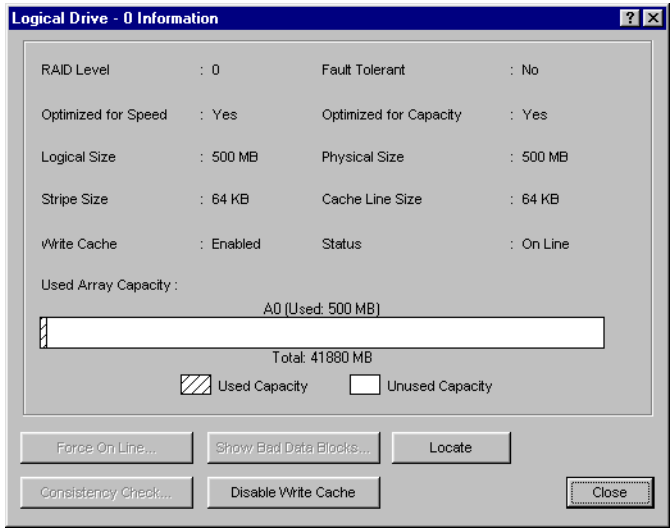


Figure 5-6. Logical Drive Information for a RAID Controller

Logical Drive Information displays the following about the currently-selected logical drive:

- The logical drive number (in the window’s titlebar)

- The RAID level at which the logical drive is configured
- Whether the logical drive's configuration is optimized for speed, optimized for capacity, and fault tolerant [Yes/No]
- The logical and physical size of the logical drive
- The stripe size and cache line size in use by the logical drive
- Whether write back cache is enabled or disabled
- The operational status of the logical drive
- The total amount of capacity held by this logical drive (shown in a bar graph)

If write back cache is disabled, click the Enable Write Cache button to enable the cache.

If write back cache is enabled, click the Disable Write Cache button to disable the cache (and use write-through caching).

If the Consistency Check button is enabled, you may manually run a consistency check on this logical drive. A Consistency Check dialog box will open asking if a Consistency Check with restore is wanted.

If the logical drive has been placed offline due to some external cause, such as a power failure affecting an enclosure, click Force On Line to return the logical drive to an active state. A warning window appears asking for confirmation of the force online procedure.

> ⚠ ***Caution***
>
> Forcing a logical drive online should only be done in a power failure recovery situation. Doing so at any other time may result in data loss.

Click the Locate button to "blink" the LED of the physical devices that comprise the Logical Drive to reveal their location. Click OK or press the Enter key to end the locate operation and return to normal status.

Click the Close button or press the Enter key to close the dialog box.

Enclosure Monitoring and Management

The Controller View window contains an Enclosure button with a status light. A Green square indicates OK, a Yellow circle indicates Critical status, and a Red X indicates failed status. You can monitor information, status, and additional details about SES and SAF-TE enclosures by clicking the Enclosure button in Controller View. Alternatively, you can select Enclosure Information from the Administration menu as shown in Figure 5-7.

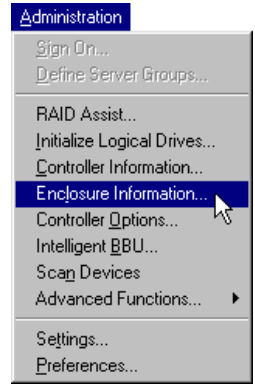


Figure 5-7. Select "Enclosure Information"

The Enclosure Information dialog box is displayed with the Information page active (Figure 5-8).

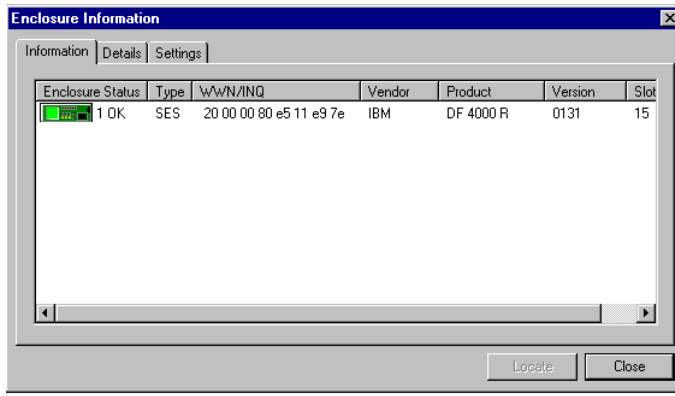


Figure 5-8. SES Enclosure Information – Information Page

Information Page

Enclosure Information displays the following about the currently-available enclosures:

- The status of each enclosure, identified by an icon and an enclosure number (1–32)[1], as well as one of the following expressed in text:
  - OK – All components are optimal.
  - Critical – Some component has failed; one more failure may result in data loss.
  - Failed – A failure has occurred that may result in data loss.
- The enclosure type (SES, SAF-TE)
- The World Wide Name or Inquiry (WWN/INQ) for the enclosure:
  - For SES – The World Wide Name as 8 hex bytes.
  - For SAF-TE – The first 8 bytes of the Inquiry command's data.
- The vendor identification

1. An undetermined enclosure shows as a zero (0). In this case, all information is presented as if there is a single enclosure with all the fans, power supplies, etc.

- The product identification
- The product revision level
- The number of drive slots in the enclosure cabinet

Highlight an enclosure and the Locate button will become available. Click the Locate button to “blink” the LEDs of all of the physical drives in the enclosure to reveal its location. A locate enclosure dialog box will open, click OK or press the Enter key to end the locate operation.

Click the Close button or press the Enter key to close the dialog box.

Details Page

Select the Details Tab to display Enclosure Information Details (Figure 5-9).

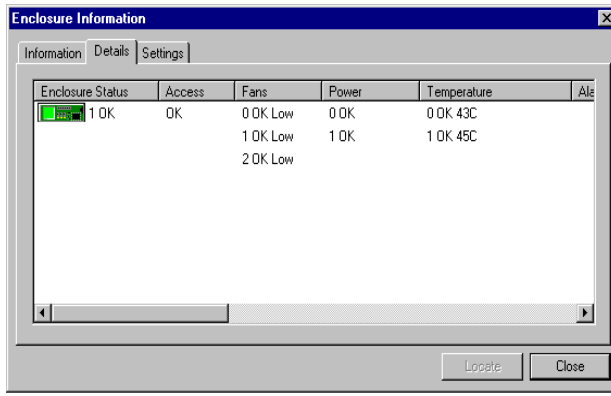


Figure 5-9. SES Enclosure Information – Details Page

Enclosure Information Details page displays the following about the currently-available Fibre enclosures:

The status of each enclosure, identified by an icon and an enclosure number, as well as one of the following expressed in text:

- OK – All components are optimal.
- Critical – Some component has failed; one more failure may result in data loss.

- Failed – A failure has occurred that may result in data loss.

The access status of each enclosure, which indicates the controller's ability to communicate with the enclosure. The status values are:

- OK – Access is optimal.
- Critical – Only one access path remains of the several that were detected previously. If the last access path is lost, the controller will take steps to protect the data.
- Lost – The enclosure is unreachable by the controller. Any failures in the enclosure while this state exists will not be sensed by the controller.

The speed of the fans in the enclosure. Each fan is designated with a number. The status values are:

- Absent – The fan is not installed, or has failed in an undetectable way.
- OK – The fan is optimal. Fan speed is shown as either Stopped, Low, or High. (Speed is not shown for SAF-TE enclosures.)
- Failed – The fan is installed, but has failed.

The status of the power supplies in the enclosure. Each power supply is designated with a number. The status values are:

- Absent – The power supply is not installed, or has failed in an undetectable way.
- OK – The power supply is optimal.
- Failed – The power supply is installed, but has failed.

The status of the temperature sensors in the enclosure. Each temperature sensor is designated with a number. The status values are:

- Absent – The temperature sensor is not installed, or has failed in an undetectable way.
- OK – The temperature sensor is optimal. Two additional items are displayed with this state: Celsius Temperature (range for SES is -19º to +235º; range for SAF-TE is -10º to +245º); Over Temperature Warning (OT).
- Failed – The temperature sensor is installed, but has failed.

The status of the alarms in the enclosure. Each alarm is designated with a number. The status values are:

- Absent – The alarm is not installed, or has failed in an undetectable way.
- OK – The alarm is optimal. One additional item is displayed with this state: ON – the alarm is currently on or sounding.
- Failed – The alarm is installed, but has failed.

The status of the enclosure's connection to one or more Uninterruptable Power Supplies (UPS). Each UPS is designated with a number. The status values are:

- Absent – The UPS is not installed, or has failed in an undetectable way.
- OK – The UPS is optimal. Three additional items are displayed with this state: AC Pwr – the UPS is reporting an AC power failure; DC Pwr – the UPS is reporting a DC power failure; Low Bat – the UPS can power the system for only 2 to 5 more minutes.
- Failed – The UPS is installed, but has failed.

Error status for troubleshooting purposes. Error status for an enclosure is reported in a format similar to the following example:

```
0 Addressing 25 02:03 04:05
```

- *0* is the error number.
- *Addressing* is the error type.
- *25* is the ALPA (Arbitrated Loop/Port Address) of the drive in question.
- *02:03* is the first known channel and target to which the ALPA is mapped.
- *04:05* is the second known channel and target to which the ALPA is mapped.

An information field which contains most of the items listed on the Information page for easier cross-reference.

Highlight an enclosure and the Locate button will become available. Click the Locate button to "blink" the LEDs of all of the physical drives in the enclosure to reveal its location. A locate enclosure dialog box will open;

click OK or press the Enter key to end the locate operation and return to normal status.

Click the Close button or press the Enter key to close the dialog box.

Settings Page

Select the Settings tab to display Enclosure Information Settings (Figure 5-10).

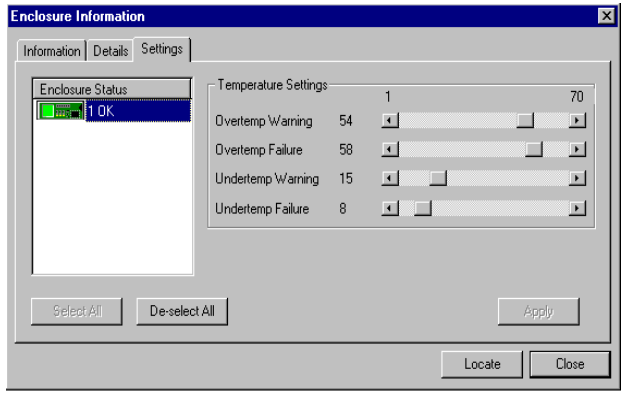


Figure 5-10. SES Enclosure Information - Settings Page

The Enclosure Information Settings page displays the current settings for the Over Temperature Shutdown thresholds in degrees Centigrade, and allows you to change those settings. Settings can be selected one enclosure at a time, or all enclosures can be set at once.

The parameters that are set on this display are:

- Overtemp Failure – This is the high safe limit. If the enclosure temperature exceeds this setting, an over temperature shutdown is activated.
- Overtemp Warning – This is the high working limit. If the enclosure temperature exceeds this setting, an event is reported in the event log.
- Undertemp Warning – This is the low working limit. If the enclosure temperature falls below this setting, an event is reported in the event log.

- Undertemp Failure – This is the low safe limit. If the enclosure temperature falls below this setting, an over temperature shutdown is activated.

These temperature settings must adhere to the following rule:

Undertemp Failure <= Undertemp Warning < Overtemp Warning <= Overtemp Failure

Refer to page 4-7 for more information on the Over Temperature Shutdown feature.

Process Status Monitoring

If logical drives are currently being initialized, open the Long Op Status box as shown in Figure 5-11 to monitor the initialization progress.

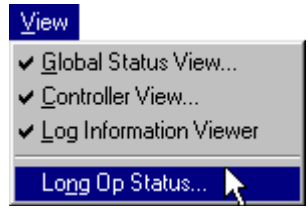


Figure 5-11. Select "Long Op Status"

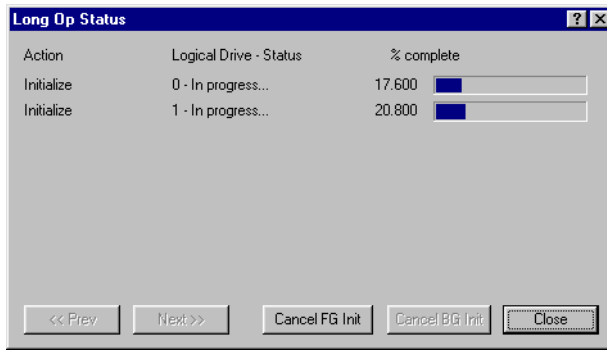


Figure 5-12. Long Op Status Box

The Long OP Status box (Figure 5-12) displays the progress of one or more full logical drive initializations. You may cancel the initialization by clicking the available Cancel button.

Rebuild Status

If a rebuild process is currently underway, open the Long Op Status box as shown in Figure 5-11 to monitor the rebuild progress or cancel the process.

The Long Op Status box (Figure 5-13) displays the progress of a physical drive rebuild. The command rebuilds *all* logical drives that occupy any portion of the targeted physical drive.

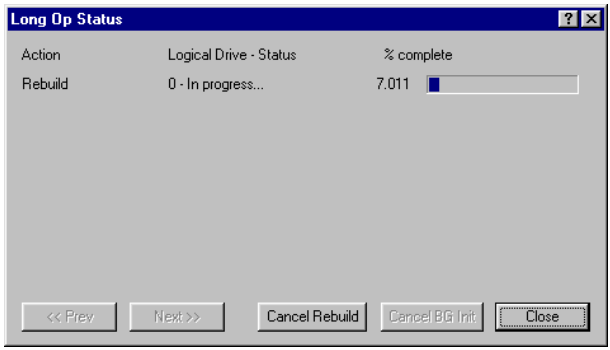


Figure 5-13. Rebuild Status Box

Click Cancel Rebuild to stop the rebuild.

Click Close or press the Enter key to exit the Long Op Status dialog box at any time.

Consistency Check Status

If a consistency check process is currently underway, open the Long Op Status box as shown in Figure 5-11 to monitor the consistency check progress or cancel the process.

The Long Op Status box (Figure 5-14) displays the progress of a logical drive consistency check.

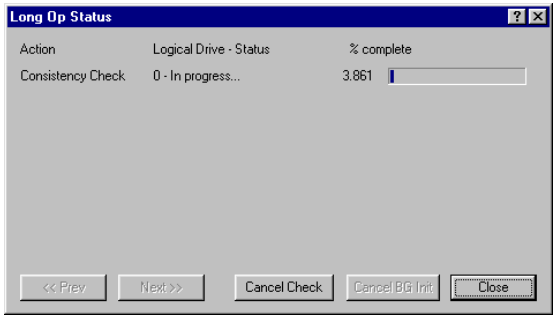


Figure 5-14. Consistency Check Status Box

Click Cancel Check to stop the consistency check.

Click Close or press the Enter key to close the Long Op Status box at any time.

Expand Capacity Status

If an expand array process is currently underway, open the Long Op Status box as shown in Figure 5-11 to monitor the progress of this process.

The Long Op Status box (Figure 5-15) displays the progress of a disk array capacity expansion.

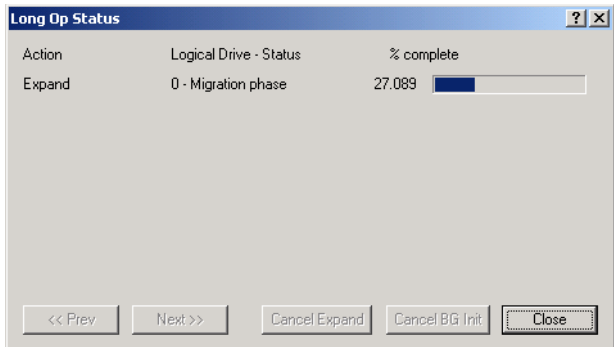


Figure 5-15. Long Ops Status Box – Expand Capacity

WARNING

Expand Capacity cannot be cancelled.

Click Close or press the Enter key to close the Expand Capacity Status box at any time.

Battery Backup Unit Monitoring and Maintenance

If your controller is equipped with an Intelligent Battery Backup Unit (BBU), you will be able to open the BBU dialog box as shown in Figure 5-16:

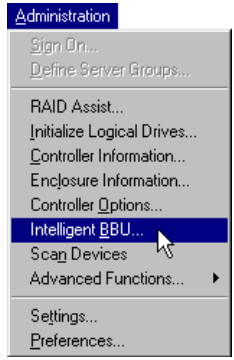


Figure 5-16. Select "Intelligent BBU"

Figure 5-17 shows the Intelligent BBU window for all controllers.

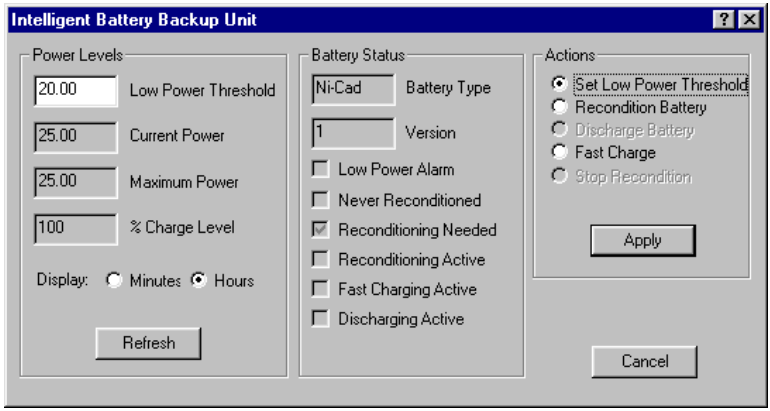


Figure 5-17. Intelligent BBU

The Intelligent Battery Backup Unit (BBU) dialog box is used to monitor and charge or recharge the backup battery pack on the controller. This battery pack maintains the controller's data in RAM in case AC power is lost to the disk storage system. When a new battery is needed, the BBU dialog indicates this by showing the battery can no longer take or hold a charge. This dialog box is also used after an old battery pack is replaced with a new

one. The new battery must be reconditioned before it can provide its full capacity.

Prior to beginning normal operations, Mylex recommends that you condition the battery for maximum longevity. See “Conditioning the Battery” on page 5-25.

Power Levels

The Power Levels area of the Intelligent Battery Backup Unit dialog box contains the following:

- **Low Power Threshold**. A modifiable power level, expressed as hours or minutes of charge, used to trigger an alarm when the battery power level drops below the set value. Enter a new threshold, select “Set Low Power Threshold” under Actions, then click Apply to set the new value.
- **Current Power**. The current power level of the battery expressed as hours or minutes of charge. This value will change as the battery is discharged or charged.
- **Maximum Power**. The highest level the battery has been charged up to expressed as hours or minutes of charge. This value will change as the battery ages and is reconditioned. The older the battery gets, the less charge it can contain.
- **% Charge Level**. The battery's charge level, where 100% means the battery has been charged up to its maximum level.
- **Display: Minutes**. Displays power values in minutes.
- **Display: Hours**. Displays power values in hours and tenths of hours.
- **Refresh**. Updates the Power Levels and Battery Status groups. It is useful during a lengthy operation such as a recondition to update the dialog without leaving it and re-entering.

Battery Status

The Battery Status area of the Intelligent Battery Backup Unit dialog box contains the following:

- **Battery Type**. The battery pack type. Available options are dependent on the controller hardware. For additional details, consult the OEM hardware reference manual for the particular controller of interest.
- **Version**. Version number for the BBU type. Version selection numbers are from 0 to 255. The version number used for the first release is 1.

The following are read-only checkbox items which indicate the battery status:

- **Low Power Alarm**. A low power condition exists as defined when the Current Power value drops below the Low Power Threshold value.
- **Never Reconditioned**. Battery has not been fully discharged before it was charged up. A new battery will have this checked until it has been fully discharged and then charged by the Recondition Battery selection under Actions.
- **Reconditioning Needed**. Battery has not been reconditioned within 30 discharge/charge cycles. Select “Recondition Battery” under Actions, then click Apply.
- **Reconditioning Active**. Process of discharging/recharging the battery is underway. Allow the process to complete or it will have to be repeated. If you do need to interrupt reconditioning, select “Stop Recondition” under Actions, then click Apply.
- **Fast Charging Active**. Battery is being charged. A fast charge also occurs when the controller is powered on.
- **Discharging Active**. Battery is currently discharging, which is the first stage of a Recondition Battery action.

Actions

The Actions area of the Intelligent Battery Backup Unit dialog box contains the following:

- **Set Low Power Threshold**. Edit the Low Power Threshold field under Power Levels. To change the threshold to this new setting, select Set Low Power Threshold, then click Apply.
- **Recondition Battery**. To initiate a battery recondition sequence, select Recondition Battery, then click Apply. The controller cache is placed in conservative cache mode (Write Through) while the battery’s capacity remains below the determined threshold.
- **Discharge Battery**. Currently inactive. Reserved for future use.
- **Fast Charge**. To initiate a fast charge on the battery, select Fast Charge, then click Apply. A fast charge also occurs when the controller is powered on.

- **Stop Recondition**. Only enabled when a recondition process is underway. To stop the recondition process, select Stop Recondition, then click Apply.
- **Apply**. Applies and saves the changes made in the BBU dialog box.
- **Cancel**. Exits the dialog box but does not stop the current action.

Conditioning the Battery

A full battery condition cycle consists of discharging and recharging the battery. The condition cycle must start with a fully charged battery. Normally, the battery is automatically recharged, but in a new system or a system that has been subjected to a power outage, recharging may be necessary and may take several hours.

> ☛ **Note**
>
> Do not interrupt the reconditioning process.

The system administrator must initiate the condition cycle manually. The condition cycle must complete without an interruption of power. In addition, the operator must not interrupt the cycle by initiating a fast charge or other action. If the cycle is interrupted for any reason, the batteries must be recharged and the recondition process must be restarted.

> ☛ **Note**
>
> During the reconditioning, write back cache mode will be disabled. This may slow normal operations. Therefore, schedule this operation accordingly.

To ensure that the battery is fully charged and properly conditioned:

1. Choose Intelligent BBU from the Administration menu if the BBU dialog box is not currently displayed.

   > ⚠ ***Caution***
   >
   > The BBU dialog box applies only to the selected controller. To see the partner controller's dialog box, select the partner controller.

2. Make sure the "% Charge Level" is 100. If the battery is currently charging, do not continue until the Charge Level is 100.

3. Under Actions, select Recondition Battery, then click Apply.

Chapter 6
Maintenance Processes

Introduction

Maintenance processes include the following activities which you may need to perform from time to time on arrays that use redundancy and/or fault tolerance, or to maintain the most up-to-date firmware maintenance releases.

- Running a logical drive initialization
- Running a consistency check on a logical drive
- Running a data rebuild on a physical drive
- Upgrading controller firmware
- Adding an SES Enclosure to a configured system
- Retrieving a Debug Dump
- Performing a safe controller Shutdown
- Deleting a Logical Drive

Running a Logical Drive Initialization

Logical drive initialization offers the ability to run a full initialization of logical drives at a time of your choice, not just immediately following a new configuration. If it's inconvenient to follow a configuration immediately with a logical drive initialization, you can decline the initialization and use this menu item to start the process at a later time.

To open Initialize Logical Drives click **Administration->Initialize Logical Drives** on the menu bar as shown in Figure 6-1.

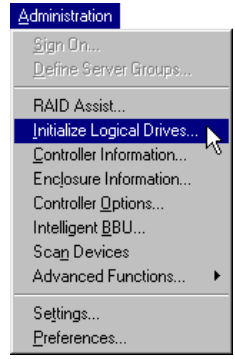


Figure 6-1. Select "Initialize Logical Drives"

An Initialize Logical Drives dialog box opens (Figure 6-2).

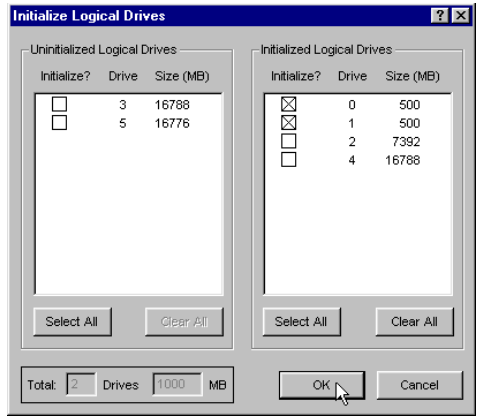


Figure 6-2. Initialize Logical Drives Dialog Box

To select logical drives to initialize check the desired checkboxes next to the appropriate logical drive. Click The OK button or press the Enter key to begin the initialization. A Warning message dialog box will open for confirmation.

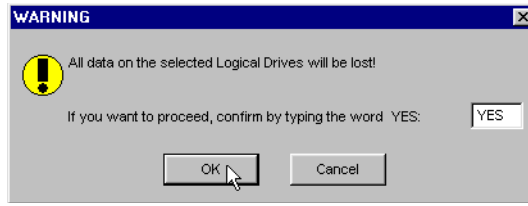

WARNING
All data on the selected Logical Drives will be lost!
If you want to proceed, confirm by typing the word YES:
YES
OK
Cancel

Figure 6-3. Initialization Confirmation Dialog Box

Type YES to confirm the initialization and click the OK button or press the Enter key. The Long Op Status Dialog box opens (Figure 6-4).

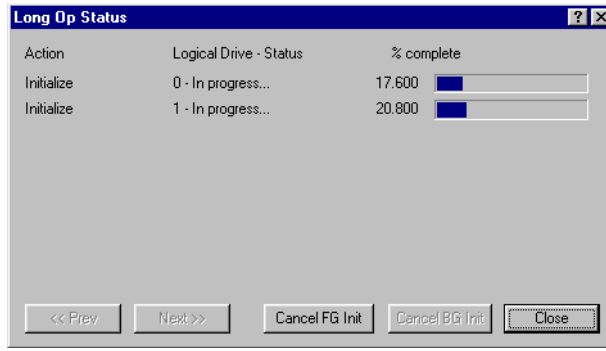


Figure 6-4. Long Op Status Dialog Box

This dialog box is used to monitor and/or cancel initializations. See “Process Status Monitoring” on page 5-18 for more information.

Running a Logical Drive Consistency Check

> **Note**
>
> Depending on the Logical Drive size, this operation may take an extended period of time. IO performance will be impacted.

From time to time, run a consistency check on each of your fault tolerant logical drives. This check scans the logical drive to determine whether consistency data has become corrupted and needs to be restored. If you have reason to believe that logical drive consistency data is corrupted, or if you wish to run a consistency check for maintenance reasons, perform the following procedure:

1. Double-click a logical drive in Controller View (right side of a Controller View window).
2. Click the Consistency Check button in the Logical Drive Information dialog box to begin (see Figure 6-5).

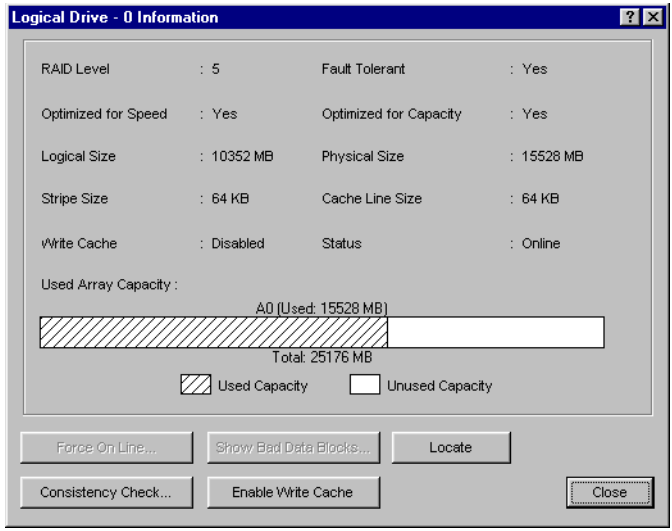


Figure 6-5. Logical Device Information Window – Select "Consistency Check"

A message is displayed asking if you would like consistency to be restored in the event of errors (Figure 6-6):

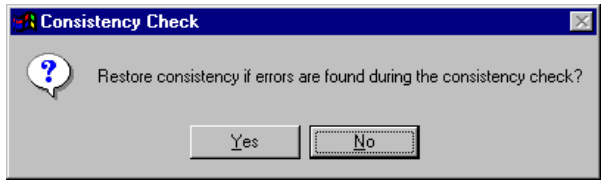


Figure 6-6. Restore Consistency If Errors Are Found?

3. Click Yes to restore consistency during the process.

   Click No if you just want to carry out the consistency check. There is no risk of data loss. Errors will still be reported, but no attempt will be made to correct them.

Consistency Check runs and the Long Op Status box appears (see “Consistency Check Status” on page 5-20). Close the box and continue or leave the box open until Consistency Check has completed.

Running a Device Rebuild

A rebuild is the re-generation of user data and redundant data onto a replacement drive using existing redundant data. Rebuilds have the following attributes:

- Rebuilds are fully automatic with generic controller setups.
- With ARM (Auto Rebuild Management, see “Advanced Controller Options” on page 4-4) enabled the user need only remove failed drives and restock with spare drives. Operation with ARM disabled is not recommended.
- Arrays are rebuild candidates only if all of the logical drives use a redundant Raid level (1, 3, 5, 0+1).
- In dual-active systems only the slot 0 controller will perform a rebuild and display the rebuild progress.

If you need to perform a device rebuild, use the following procedure:

1. Reinsert the removed drive that caused the failure, if it is still a good drive, or replace the failed drive with a new drive of equal or greater capacity.
2. Double-click the relevant physical device in the Controller View window.

   The Disk Device Information dialog box will open, and the Rebuild button should be available (Figure 6-7).

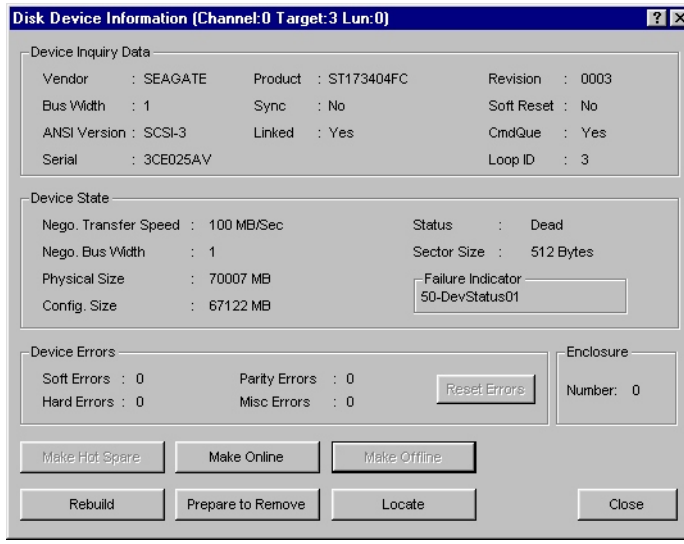


Figure 6-7. Rebuild Button Available for This Disk Device

3. Click the Rebuild button in the Disk Device Information dialog box. Controllers perform rebuilds automatically. You need only click the Rebuild button to restart a stopped rebuild (and only on slot 0 if dual-active).

Rebuild runs and the Long Op Status box appears (see“Rebuild Status” on page 5-19). Close the box and continue or leave the box open until Rebuild has completed.

When rebuild has completed, the selected physical device AND the logical drive(s) of which it is a part are returned to operational status. If you cancel rebuild, the device returns to its offline (dead) status (red X), and the logical drives that occupy this physical device all go to critical status (yellow exclamation point). You must complete a future rebuild to return the physical device and logical drive(s) to operational status.

Using the Flash Utility

If you are upgrading your firmware to 7.x or higher, you must reboot the host system after completing this procedure. The Flash Utility is used to upgrade firmware by "flashing" the new code stored in an identified .IMA file to the on-board flash memory. As maintenance releases of this code become available, this utility allows you to keep your controller current using SANArray Manager.

Open the Flash Utility as shown in Figure 6-8.

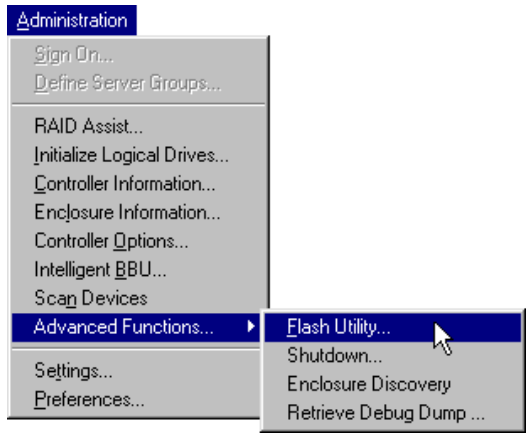


Figure 6-8. Select "Flash Utility"

A message will appear notifying you that all I/O will be stopped before downloading. Click the OK button or press the Enter key to continue.

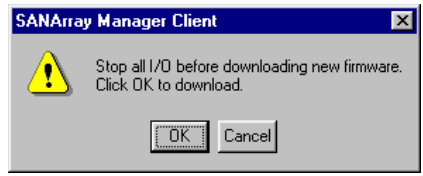


Figure 6-9. Stop All I/O Message

The Flash Utility dialog box appears as shown in Figure 6-10:

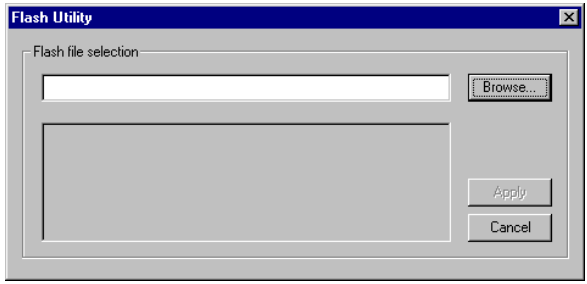


Figure 6-10. Flash Utility Dialog Box

The Flash Utility dialog box comes up with no information specified.

To do a flash upgrade:

1. Type the name of the appropriate image file (.IMA) in the Flash file selection box, or click the Browse button to locate the file.

   If you select Browse, the Open Image file dialog box is displayed as shown in Figure 6-11.

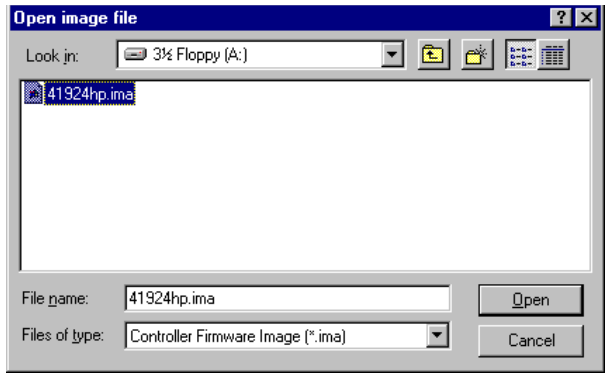


Figure 6-11. Open Image File Dialog Box

2. Navigate to and select the image file name.
3. Click Open.

Once you've specified an appropriate image file, the Apply button becomes available in the Flash Utility dialog box, and the Flash file selection area displays details regarding the .IMA file (Figure 6-12).

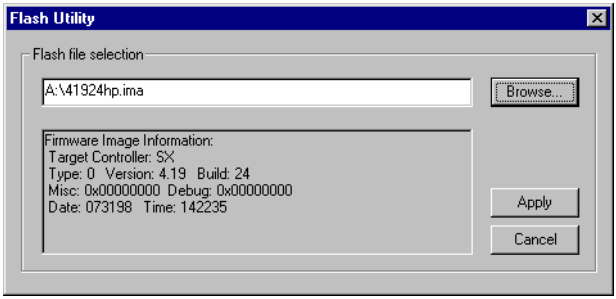


Figure 6-12. Additional Flash File Information

4. Compare the information for the new .IMA with the current information to confirm that a flash is warranted (for example, that the .IMA contains a newer version of code).
5. Click Apply.

   Because flashing new code to the controller erases what was there previously, confirmation is required to proceed with the flash (Figure 6-13).

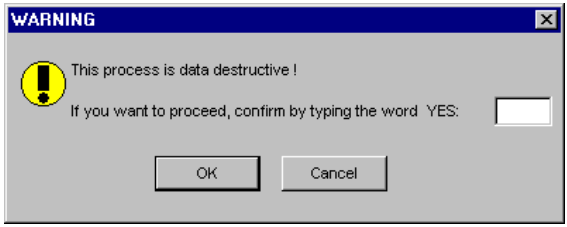


Figure 6-13. WARNING Message for Flash

6. Type YES, then click OK or press the Enter key at the confirmation message.

   The Flash Utility transfers the image data to the controller and resets the controller. The following reset notification (Figure 6-14) will display:

Figure 6-14. Firmware Reset Notification

Enclosure Discovery

The Enclosure Discovery feature allows you to add an SES enclosure(s) to a configured system while the system continues to operate. This feature starts the SES monitoring process for the new cabinet from the GUI. You can then configure the additional disk capacity without rebooting the system.

> ☛ **Note**
>
> Ensure that the enclosure is powered on before making an SES Discovery request or the devices will not appear in the Controller View window.

To make an SES Discovery request:

1. Start Enclosure Discovery. Select **Administration->Advanced Functions->Enclosure Discovery**.

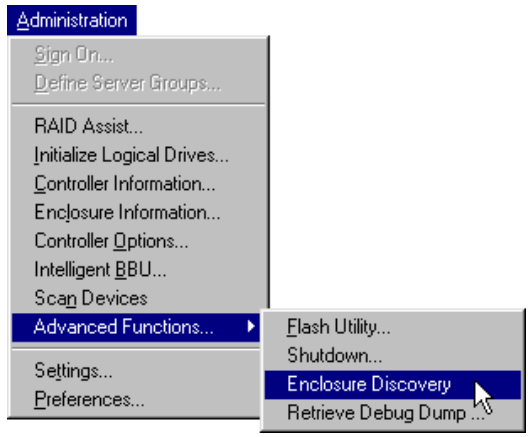


Figure 6-15. Select "Enclosure Discovery"

An Enclosure scan will be performed and will take approximately 20 seconds. After the scan has been requested, the following dialog box (Figure 6-16) will instruct you to await the completion.

Figure 6-16. Enclosure Discovery Operation Inprogress

Once the event signaling a new enclosure and its drives displays in the Log Information Viewer, perform a Scan Devices to refresh the GUI.

Retrieving a Debug Dump

The Retrieve Debug Dump command (Figure 6-17) allows you to retrieve an unread debug dump from the controller and save the information to a file (extension .RDD). Offline applications must be used to examine the dump file. SANArray Manager only supports retrieving and saving the data.

1. Open Debug Dump. Select **Administration->Advanced Functions->Retrieve Debug Dump**.

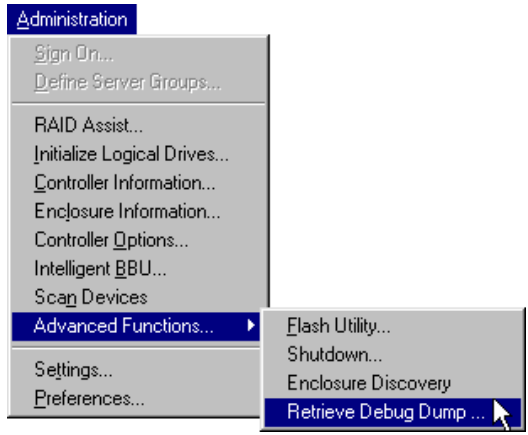


Figure 6-17. Select "Retrieve Debug Dump"

2. The Retrieve Debug Dump dialog box opens (Figure 6-18).

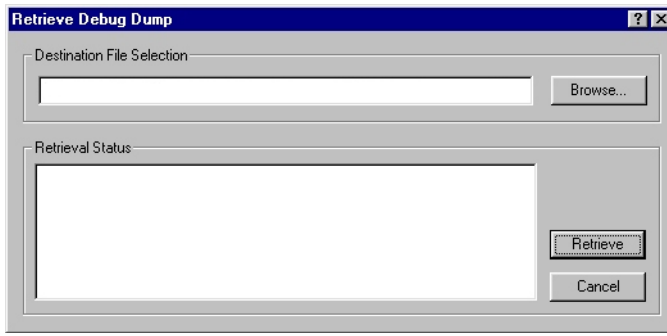


Figure 6-18. Retrieve Debug Dump Dialog Box

3. Type the name of the destination dump file (.RDD) in the Destination File Selection box, or click the Browse button to locate a file. If you select Browse, the Debug Dump save file name dialog box is displayed (Figure 6-19).

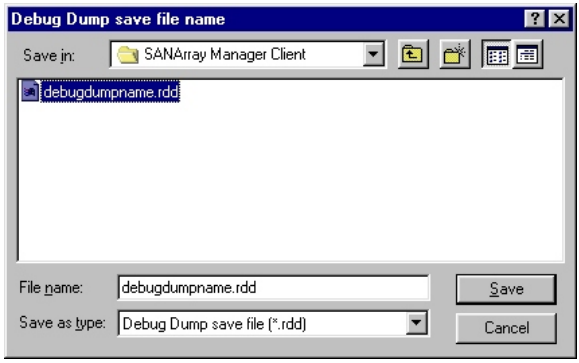


Figure 6-19. Debug Dump Save File Dialog Box

4. Navigate to and select the debug file name.
5. Click Save. Once you have specified an appropriate debug file, the Retrieve button becomes available in the Retrieve Debug Dump dialog box.
6. Click Retrieve. The Retrieval Status area displays details regarding the data dump, such as firmware version, abort code, source file name, and line number. Data goes to the .RDD file (Figure 6-20).

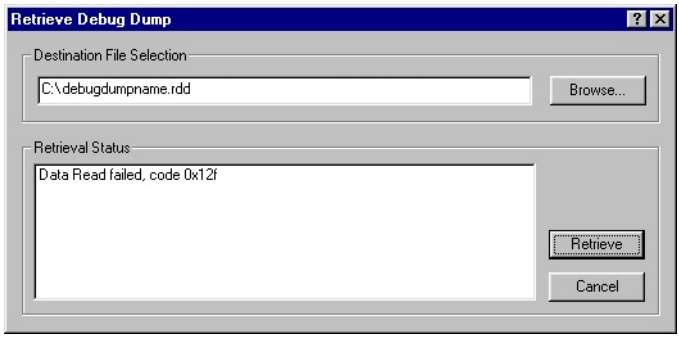


Figure 6-20. Retrieve Debug Dump Dialog Box

7. Click Cancel to close the Retrieve Debug Dump dialog box.

Performing a Controller Shutdown

The purpose of this activity is to cleanly shut down the controller system, leaving the BBU charged.

Open the Shutdown option as shown in Figure 6-21.

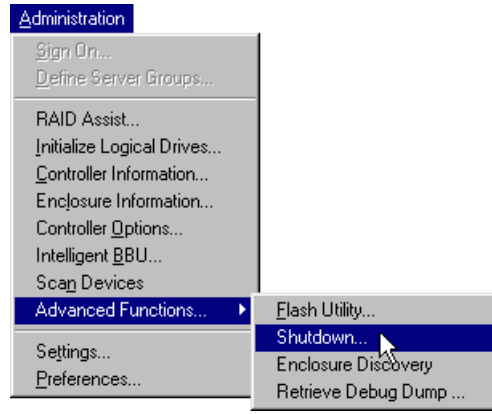


Figure 6-21. Select "Shutdown"

The Shutdown dialog box is displayed as shown in Figure 6-22.

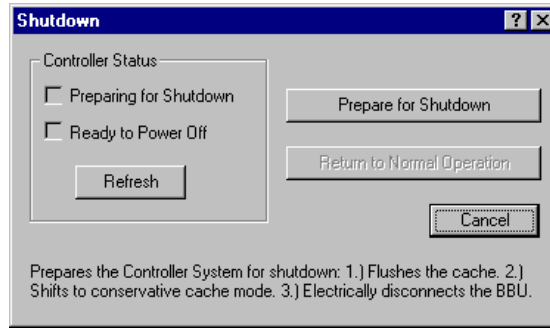

Shutdown
Controller Status
Preparing for Shutdown
Ready to Power Off
Refresh
Prepare for Shutdown
Return to Normal Operation
Cancel
Prepares the Controller System for shutdown: 1.) Flushes the cache. 2.) Shifts to conservative cache mode. 3.) Electrically disconnects the BBU.

Figure 6-22. The Shutdown Dialog Box

To perform a shutdown:

1. Click Prepare for Shutdown.

Steps are taken to prepare for a clean controller shutdown, including the following:

- Switching to write through cache
- Draining the cache
- Electrically disconnecting the BBU
- Sending instructions to the partner controller to carry out the same actions

Under Controller Status, Preparing for Shutdown will be checked while the above steps are taking place.

2. Click Refresh periodically to update status.
3. When Ready to Power Off is checked under Controller Status, click Cancel to exit the dialog box. The user may now power off the controller. The battery will remain charged and will not supply power to the cache.

To abort a shutdown or return a controller to normal operation:

1. Click Return to Normal Operation.
2. Click Cancel to close the dialog box, then continue normal use of the controller through SANArray Manager.

To update status information from the controller during shutdown click Refresh.

Deleting a Logical Drive

This function allows you to remove one or more logical drives for the purpose of rearranging your storage space.

1. Make backup copies of all user data on your array(s).
2. Select **Administration->RAID Assist**.
3. Click Manual Configuration, then Edit Configuration.
4. Go to the Logical Drives tab and highlight the drive to be deleted. Click Delete Drive.

   You can delete additional drives in the same manner and the available space can be reconfigured using the Manual Configuration options.
5. Restore user data to the desired logical drives.

Appendix A
Event Information

Overview

SANArray Manager provides information about drive and controller failures, as well as maintaining an event log. SANArray Manager classifies the events it records into five severity levels described in Table A-1. All event information can also be found in the text file EventDef.txt in the SANArray Manager Client Files folder of the SANArray Manager directory.

Table A-1. Severity Level Priorities and Descriptions

Severity	Type	Description
0	Critical	Controller failure.
1	Serious	The failure of a major component within the array enclosure. For example, a power supply, fan or physical drive.
2	Error	Messages such as a consistency check fails, or a rebuild on a drive stopped because of errors.
3	Warning	Messages such as SANArray Manager has failed to kill a drive, or failed to start a rebuild.
4	Informational	Messages such as sign-ons and system startups. When a consistency check or a rebuild has finished, for example, or a physical drive has been put on standby.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
1	4	A physical disk has been placed online.	Rebuild completed. Physical disk was configured. Manual online was done.	None.
2	4	A physical disk has been added as a hot spare.	Device was configured and is available.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
3	3	Physical disk error found.	A bad sector was found on the physical disk. Mechanical failure on the physical disk. Host SCSI device detected illegal instruction. Target device generated unknown phase sequence.	If problem occurs frequently: - Replace the physical disk. - Contact your service representative.
4	3	Physical disk PFA condition found. This disk may fail soon.	Physical disk predicted some future failure. External RAID logical device may have become critical.	Refer to the enclosure manufacturer's service manual.
5	4	An automatic rebuild has started.	A physical disk failed and spare was available. A physical disk failed and no spare was available. A spare was added.	None.
6	4	A rebuild has started.	Client started the rebuild on user's request. User replaced the failed device and raidbld started the 'raidbld'.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
7	4	Rebuild is over.	Rebuild completed successfully.	None.
8	3	Rebuild is canceled.	User canceled the rebuild. Higher priority rebuild started.	Restart the rebuild if required.
9	2	Rebuild stopped with error.	Due to some unknown error on the controller, rebuild failed.	Try rebuild again.
10	2	Rebuild stopped with error. New physical disk failed.	New physical disk failed. New physical disk may not be compatible with MDAC hardware/ firmware.	Replace the disk.
11	2	Rebuild stopped because logical drive failed.	At least one more physical disks failed in the array. Bad data table overflow.	It may not be possible to recover from this error. Contact your service representative.
12	1	A physical disk has failed.	A physical disk failed. A user action caused the physical disk to fail.	Replace the physical disk.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
13	4	A new physical disk has been found.	A physical disk has been powered on. A new physical disk has been added. Controller was powered on. Controller was added. System has rebooted.	None.
14	4	A physical disk has been removed.	User removed an unconfigured physical disk. An unconfigured physical disk failed. A controller was removed. A controller was powered off.	Replace the device if needed.
15	4	A previously configured physical disk is now available.	Physical disk was set to unconfigured.	None.
16	4	Expand capacity started.	A RAID expansion operation was started or restarted.	None.
17	4	Expand capacity completed.	RAID expansion finished.	None.
18	2	Expand capacity stopped with error.	Multiple disks may have failed.	Contact your service representative.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
19	3	SCSI command timeout on physical device.	Physical device has been removed. Physical device failed. Command time out value is not correct.	Refer to the enclosure manufacturer's service manual.
22	3	Parity error found.	A physical device did not generate proper parity. The controller failed; did not check parity properly. Cable failed. Improper cable length. Another physical device interfered. Some outside environment affected the data on the cable (e.g., radio frequency signal). Terminator is not connected. Improper termination.	Refer to the enclosure manufacturer's service manual.
25	4	SCSI device reset.	Firmware has done a reset to recover from an error. User has done a reset.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
28	2	Request Sense data available.	A physical device or firmware reported an error.	Refer to the Request Sense data for information.
29	4	Initialization started.	Host started initialization.	Wait until complete.
30	4	Initialization completed.	Physical device initialization completed successfully.	None.
31	2	Initialization failed.	Physical device could have problems supporting the SCSI format command.	Re-initialize; contact your service representative.
33	1	A physical disk failed because write recovery failed.	Write recovery process failed.	Replace physical disk and rebuild it.
34	1	A physical disk failed because SCSI bus reset failed.	SCSI bus reset failed.	Replace physical disk and rebuild it.
35	1	A physical disk failed because double check condition occured.	Double check condition occurred.	Replace physical disk and rebuild it.
36	1	A physical disk failed because device is missing.	Access to the physical disk failed.	Replace physical disk and rebuild it.
37	1	A physical disk failed because of gross error on SCSI processor.	Gross error occurred to the on board SCSI processor.	Replace physical disk and rebuild it.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
38	1	A physical disk failed because of invalid tag.	The physical disk responded with an invalid tag.	Replace physical disk and rebuild it.
39	1	A physical disk failed because a command timed out.	SCSI command timed out on the physical disk.	Replace physical disk and rebuild it.
40	1	A physical disk failed because of the system reset.	System reset occurred.	Replace physical disk and rebuild it.
41	1	A physical disk failed because of busy status or parity error.	The physical disk returned busy status. The SCSI transaction with the physical disk met with parity error.	Replace physical disk and rebuild it.
42	1	A physical disk set to failed state by host.	Command from host set the physical disk to failed state.	Replace physical disk and rebuild it.
43	1	A physical disk failed because access to the device met with a selection time out.	Physical disk disconnected or powered off. Physical disk failure.	Replace physical disk and rebuild it. Check power and cabling.
44	1	A physical disk failed because of a sequence error in the SCSI bus phase handling.	Physical disk failure.	Replace physical disk and rebuild it.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
45	1	A physical disk failed because device returned an unknown status.	Bad physical disk or incompatible device.	Replace physical disk or the device and rebuild it.
46	1	A physical disk failed because device is not ready.	Physical disk not spinning, just turned bad. Power to the physical disk failed.	Replace physical disk and rebuild it. Check power and rebuild device.
47	1	A physical disk failed because device was not found on start up.	Physical disk not connected or not responding. Clear configuration suspend mode command was invoked.	Check setup. Check the startup option parameters on the system.
48	1	A physical disk failed because write operation of the 'Configuration On Disk' failed.	Failed physical disk. Device write protected.	Replace physical disk and rebuild it. Check the startup option parameters on the system.
49	1	A physical disk failed because write operation of 'Bad Data Table' failed.	Failed physical disk. Device write protected.	Replace physical disk and rebuild it. Check the startup option parameters on the system.
50	3	Physical disk status changed to offline.	Physical disk status changed to offline.	None.
51	3	Physical disk status changed to Hot Spare.	Physical disk status changed to Hot Spare.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
52	3	Physical disk status changed to rebuild.	Physical disk status changed to rebuild.	None.
53	3	Physical device ID did not match.	Physical device ID did not match.	None.
54	3	Physical disk failed to start.	Physical disk failed to start.	Reseat the physical disk. Replace the physical disk.
55	3	Physical disk negotiated different offset than configured.	Physical disk negotiated different offset than configured.	None.
56	3	Physical disk negotiated different bus width than configured.	Physical disk negotiated different bus width than configured.	None.
57	1	Physical disk missing on startup.	Physical disk missing.	Replace the physical drive or power-on all enclosures.
58	3	Rebuild startup failed due to lower physical disk capacity.	Physical disk capacity not sufficient for doing rebuild.	Replace with a physical disk having sufficient capacity.
59	3	Physical disk is switching from one channel to the other channel.	Physical disk removed or channel failed.	Check Fibre Channel loop. Replace physical disk if necessary.
60	2	Temporary-Dead physical disk is automatically made online.	Temporary-Dead state caused because of transient errors.	Analyze event log to find out why the physical disk was marked Dead.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
61	4	A standby rebuild has started.	A physical disk failed and spare was available.	None.
62	4	Hot spare replaced with a smaller capacity drive.	The new hot spare may have a smaller physical capacity than the drive it replaced. The controller coercion setting may have reduced the configurable size of the new hot spare.	None.
63	4	A storage access path has come online.	PathPilot reported an access path has become available. Storage previously unavailable has become available again.	None. This indicates that storage access has been restored.
64	0	A storage access path has been lost.	PathPilot is unable to access certain storage on any path. Storage previously available is now unavailable.	Investigate possible causes; e.g., cabling, controller or HBA failure.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
65	3	A storage access path has shifted to the alternate path.	PathPilot is unable to access storage on the original path but is able to use the alternate path. A PathPilot failover has occurred.	Investigate possible causes; e.g., cabling, controller or HBA failure.
66	4	A storage access path has shifted to the primary path.	PathPilot is again able to access certain storage on the original path. A PathPilot failback has occurred.	None. This indicates that the primary path has been restored.
67	2	Physical Disk is connected to only one disk channel.	Physical Disk found on only one disk channel.	Inspect disk channel cables and related hardware for proper operation.
68	4	Physical disk type is not approved by vendor.	Physical disk does not match a type allowed by the vendor. The system rejects all physical disks after the first that is not approved by the vendor.	Contact RAID controller vendor to acquire a supported drive.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
69	2	Physical disk has acquired an inappropriate loop ID. Enclosure disk-slot operations are disabled while this condition persists.	Enclosure selector switch conflict. Physical disk hardware failure. Enclosure disk-slot hardware failure.	Insure that each disk enclosure selector switch is set to a unique number per enclosure manufacturer specification. Inspect physical disk connector. Power cycle entire system. Replace physical disk. Replace disk enclosure.
70	2	Physical disk port has failed or cannot operate at the configured channel speed.	Physical disk hardware failure. Physical disk is not compatible with system. Enclosure disk slot hardware failure.	Replace physical disk. Replace disk enclosure.
71	2	Mirror Race recovery failed for logical drive.	A read or write operation failed to a physical disk while restoring redundancy.	Run consistency check and restore consistency.
96	1	Device loop ID conflict (soft addressing) detected.	Device loop ID conflict detected on disk channel resulting in soft addressing; potential data corruption.	Change index selector to enable hard addressing per enclosure manufacturer's specification.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
128	4	Consistency check is started.	User started a consistency check. 'raidbld' started consistency check.	None.
129	4	Consistency check is finished.	Consistency check completed successfully without detecting any errors.	None.
130	3	Consistency check is canceled.	User canceled the consistency check.	Restart consistency check, if required.
131	2	Consistency check on logical drive error.	Inconsistent data were found. Bad sectors were found. A physical disk reliability problem.	See bad block and request sense table for more information.
132	2	Consistency check on logical drive failed.	A logical device became critical. A logical device failed.	See request sense data for more information.
133	1	Consistency check failed due to physical disk failure.	A physical disk failed.	See request sense data for more information.
134	1	Logical drive has been made offline.	One/multiple physical disk(s) failed.	It may not be possible to recover from this error. Contact your service representative.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
135	2	Logical drive is critical.	One physical device failed.	Replace the physical device. Start the rebuild, if required.
136	4	Logical drive has been placed online.	Rebuild completed. User set the physical disk online. New configuration was added.	None.
137	4	An automatic rebuild has started on logical drive.	A physical disk failed and a spare device was available. A spare physical disk was found and replaced the failed device.	None.
138	4	A manual rebuild has started on logical drive.	Client started the rebuild on user's request. User replaced the failed device and 'Raidbld' started the rebuild.	None.
139	4	Rebuild on logical drive is over.	Rebuild completed successfully only for this logical drive.	None.
140	3	Rebuild on logical drive is cancelled.	User cancelled rebuild. Higher priority rebuild started.	Restart the rebuild if required.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
141	2	Rebuild stopped with error.	Due to an unknown error on the controller rebuild failed.	Try rebuild again.
142	2	Rebuild stopped with error. New physical disk failed.	New physical disk failed. New physical disk is not compatible with MDAC hardware/ firmware.	Replace the new device.
143	2	Rebuild stopped because logical drive failed.	At least one more physical disks.	It may not be possible to recover from this error. Contact your service representative.
144	4	Logical drive initialization started.	User started the initialization. Any previous data are lost.	None.
145	4	Logical drive initialization done.	Initialize operation completed successfully.	None.
146	3	Logical drive initialization canceled.	User canceled the initialization.	Restart initialization if required.
147	2	Logical drive initialization failed.	One/multiple physical device(s) failed. Controller has been removed. Controller has been powered off.	Refer to the device failure event.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
148	4	A logical drive has been found.	A new configuration has been added. MORE completed. A new controller has been plugged in. Controller has been powered on. System has rebooted.	None.
149	4	A logical drive has been deleted.	A new configuration has been added. A new logical device has been deleted. Controller has been removed. Controller has been powered off.	None.
150	4	Expand capacity started.	User started the online RAID expansion operation.	None.
151	4	Expand capacity completed.	Online RAID expansion completed.	None.
152	2	Expand capacity stopped with error.	Multiple physical disks failed.	It may not be possible to recover from this error. Contact your service representative.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
153	0	Bad blocks found	Bad sector was found on a physical device during consistency check/rebuild/ RAID expansion operation.	Run a consistency check with the restore option. Restore data from a back up.
154	4	Logical drive size changed.	A new configuration has been added. RAID Expansion has added extra capacity.	None.
155	4	System drive type changed.	A new configuration has been added. RAID migration completed. RAID expansion completed on RAID 1.	None.
156	1	Bad data blocks found. Possible data loss.	Bad blocks were found on multiple physical disks in same zone.	Restore data from a back up.
157	3	System drive LUN mapping has been written to configuration.	System drive LUN mapping has been written to configuration.	None.
158	1	Attempt to read data from block that is marked in Bad Data Table.	Attempt to read from block that is already marked bad in Bad Data Table. Potential data loss	Attempt to read from block that is already marked bad in Bad Data Table. Potential data loss

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
159	2	Data for Disk Block has been lost due to Logical Drive problem.	Data retained in RAID Cache for a Write-back Logical Drive cannot be stored to the physical medium because of Logical Drive problem. The Logical Drive problem could be because of multiple physical medium errors or multiple physical devices offline or other reasons.	Insure that all the physical disks related to the Logical Drive, disk channel, enclosure or cabling are functional and accessible. Repair or replace as necessary.
160	2	Temporary-Offline RAID5/RAID3 array is available to the user again with the possibility of data loss in the array.	Temporary-Offline state caused because of transient errors in physical disks.	Verify data from backup.
161	2	Temporary-Offline RAID0+1/RAID1/ RAID0/JBOD array is available to the user again.	Temporary-Offline state caused because of transient errors in physical disks.	None.
162	4	A standby rebuild has started on a logical drive.	A physical disk failed and a spare device was available	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
176	4	Logical drive background initialization started.	User may have started background initialization. Firmware may have automatically started background initialization.	None.
177	4	Logical drive background initialization stopped.	User may have stopped background initialization. Firmware may have automatically stopped background initialization.	None.
178	4	Logical drive background initialization paused.	Background initialization paused due to higher priority operation.	None.
179	4	Logical drive background initialization restarted.	Background initialization restarted after being paused.	None.
180	2	Logical drive background initialization failed.	Background initialization failed.	None.
181	4	Logical drive background initialization completed.	Background initialization completed successfully.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
182	2	Low battery charge level. Logical drive may have lost data.	Controller was powered off for duration longer than battery capacity. User connected a new controller. User connected a new BBU.	Run consistency check to verify logical drive consistency. If needed, restore data from backup.
256	1	Fan Failure.	Broken cable connection. Fan failure.	Replace fan
257	4	Fan has been restored.	Cable is connected properly. Faulty fan has been replaced.	None.
258	1	Fan failure.	Cable connection is broken. Fan failure.	Replace fan.
259	4	Storage cabinet fan is not present.	Management connection is broken. Management hardware failure. Fan is not present.	Refer to the enclosure manufacturer's service manual.
272	1	Power supply failure.	Broken cable connection. Power supply failure.	Reconnect cable or replace the power supply as required.
273	4	Power supply has been restored.	Faulty power supply has been replaced.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
274	1	Power supply failure.	Broken cable connection. Power supply failure.	Reconnect cable or replace the power supply as required.
275	4	Storage cabinet power supply is not present.	Management connection is broken. Management hardware failure. Power supply is not present.	Refer to the enclosure manufacturer's service manual.
288	3	Over temperature. Temperature is above 70 degrees Celsius.	Room temperature is too high. Fan failure. Sensor failure.	Turn off the system and allow it to cool down. Adjust the room temperature.
289	3	Temperature is above 50 degrees celsuis.	Room temperature is high. Fan failure.	Replace fan. Turn off the system. Adjust the room temperature.
290	4	Normal temperature has been restored.	Faulty fan has been replaced. Room temperature was reduced.	None.
291	1	Over temperature.	Room temperature is too high. Fan failure.	Turn off the system and allow it to cool down. Adjust the room temperature.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
292	4	Storage cabinet temperature sensor is not present.	Enclosure management connection is broken. Management hardware failure. Sensor is not present.	Refer to enclosure manufacturer's service manual.
304	1	Enclosure reported failure state.	Power supply failed. Fan failed. Cabinet is too hot.	Follow enclosure management vendor's diagnostics and repair procedures.
305	3	Enclosure reported critical state.	Enclosure reported critical state.	Follow enclosure management vendor's diagnostics and repair procedures.
306	4	Enclosure reported normal state.	Enclosure reported normal state.	None.
307	4	Uninterruptable power supply disabled.	Uninterruptable power supply disabled.	Refer to enclosure manufacturer's service manual.
308	4	Uninterruptable power supply AC failed.	Uninterruptable power supply AC failed.	Refer to enclosure manufacturer's service manual.
309	3	Uninterruptable power supply battery low.	Uninterruptable power supply battery low.	Refer to enclosure manufacturer's service manual.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
310	1	Uninterruptable power supply failed.	Uninterruptable power supply failed.	Refer to enclosure manufacturer's service manual.
311	4	Uninterruptable power supply normal.	Uninterruptable power supply normal.	None.
320	1	Fan failure.	Broken cable connection. Fan failure.	Replace fan.
321	4	Fan has been restored.	Faulty fan has been replaced. Cable is connected properly.	None.
322	4	Fan is not present.	Enclosure management connection is broken. Management hardware failure. Fan is not present.	Refer to enclosure manufacturer's service manual.
323	1	Power supply failure.	Broken cable connection. Power supply failure.	Refer to enclosure manufacturer's service manual.
324	4	Power supply has been restored.	Faulty power supply has been replaced.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
325	4	Power supply is not present.	Enclosure management connection is broken. Management hardware failure. Power supply is not present.	Refer to enclosure manufacturer's service manual.
326	1	Temperature is over safe limit. Failure is imminent.	Room temperature is too high. Fan failure. Sensor failure.	Turn off the system and let it cool down. Adjust the room temperature.
327	3	Temperature is above working limit.	Room temperature is high. Fan failure.	Replace fan. Adjust the room temperature.
328	4	Normal temperature has been restored.	Faulty fan has been replaced. Room temperature was reduced.	None.
329	4	Temperature sensor is not present.	Enclosure management connection is broken. Management hardware failure. Sensor is not present.	Refer to enclosure manufacturer's service manual.
330	3	Enclosure access critical.	Enclosure management connection is broken. Management hardware failure.	Refer to enclosure manufacturer's service manual.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
331	4	Enclosure access has been restored.	Enclosure has been fixed or replaced.	None.
332	1	Enclosure access is offline.	Enclosure management connection is broken. Management hardware failure.	Refer to enclosure manufacturer's service manual.
333	1	Enclosure soft addressing detected.	Enclosure has duplicate loop IDs (soft addressing). Potential data corruption.	Refer to enclosure manufacturer's service manual.
334	4	Enclosure services ready.	–	None.
335	4	Access to temperature sensor has been lost.	Module containing temperature sensor has been removed.	None.
336	4	Access to power supply status information has been lost.	Module establishing connectivity has been removed.	None.
337	4	Access to fan status information has been lost.	Module establishing connectivity has been removed.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
338	1	Physical disks in enclosure being spundown.	Enclosure temperature is too high. Fan failure. Sensor failure.	Turn off the enclosure and repair problem causing critical over temperature condition. Once the problem is repaired, recover by power cycling the entire system including controllers.
339	2	Temperature is below working limit.	Room temperature too low. Sensor failure.	Inspect the enclosure environment for proper operation, repair as required. Increase room temperature as required.
340	1	Temperature is under safe limit. Failure imminent.	Room temperature too low. Sensor failure.	Inspect the enclosure environment for proper operation, repair as required. Increase room temperature as required.
384	4	Array management server software started successfully.	The server system (or array management utility server) started.	If you did not expect a system reboot, investigate.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
385	2	Write back error.	Data cache write failed.	The data may have been lost. Restore the data from a backup.
386	3	Internal log structures getting full. PLEASE SHUTDOWN AND RESET THE SYSTEM IN THE NEAR FUTURE.	Too many configuration changes occurred since the last boot.	Reboot the system by power cycling when convenient.
389	3	Controller has been reset.	Controller received a reset command.	If this was an unexpected event, refer to the enclosure manufacturer's service manual.
390	4	Controller is found.	New controller has been installed. Management software has restarted. System has rebooted.	None.
391	0	Controller is gone. System is disconnecting from this controller.	Controller has been powered off or has been reset. Controller has been removed from the system.	None.
392	4	Battery present.	A battery module has been detected and is now operational.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
393	3	Battery power low.	Battery power is low.	If this message occurs without power failure, replace the battery.
394	4	Battery power OK.	Battery has enough power to enable the write data cache.	None.
395	0	Controller is gone. System is disconnecting from this controller.	The connection to the controller has been lost.	None.
396	4	Controller powered on.	Controller was removed from the system. Controller has been powered off.	None
397	4	Controller is online.	New controller has been installed.	None.
398	0	Controller is gone. System is disconnecting from this controller.	Controller was set offline.	None.
399	3	Controller's partner is gone. Controller is now in failover mode.	Controller was set offline.	If you did not expect this, investigate.
400	4	Battery reconditioning is started.	User started a battery reconditioning.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
401	4	Battery reconditioning is finished.	Battery reconditioning completed successfully.	None.
402	4	Battery reconditioning is canceled.	User canceled the battery reconditioning.	Restart the battery reconditioning, if required.
403	1	Installation aborted.	Equipment improperly arranged while powered off.	Re-establish proper arrangement.
404	1	Controller firmware mismatch.	Replacement controller with down level firmware installed.	Reload controller firmware.
405	3	Battery removed.	Battery physically removed.	Reinstall the battery.
406	1	WARM boot failed.	Memory error detected during WARM boot scan. Possible data loss.	Restore data from a backup.
407	4	Battery calibration cycle started	New battery detected.	None.
408	4	Battery calibration cycle finished.	Battery calibration completed successfully.	None.
409	4	Battery calibration cycle was canceled.	User canceled the battery calibration cycle.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
410	4	Battery is not present.	The battery electronics are present, but a battery was not detected.	Install or connect the battery.
411	3	Controller entered conservative cache mode.	User changed the setting. Controller preparing for shutdown. Battery low. RAID expansion in process. Over-temperature condition. No redundant power. Power supply failure. UPS ac failed. UPS battery low.	If this was an unexpected event, refer to the enclosure manufacturer's service manual.
412	3	Controller entered normal cache mode.	Controller entered normal cache mode.	None.
413	3	Controller device start completed.	Controller device start completed.	None.
414	3	Soft ECC error corrected.	Faulty memory module.	Replace memory module.
415	3	Hard ECC error corrected.	Faulty memory module.	Replace memory module.
416	4	Battery recondition suggested.	Battery recondition suggested.	None.
417	3	Controller's partner has been removed.	Controller's partner has been removed.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
418	2	BBU out of service.	BBU will not be able to power the cache if AC power fails. Firmware will switch WriteBack logical drives to WriteThrough.	Replace BBU.
419	3	Updated partner's status.	Updated partner's status.	None.
420	3	Relinquished partner.	Relinquished partner.	None.
421	3	Inserted partner.	Inserted partner.	None.
422	3	Dual controllers enabled.	Dual controllers enabled.	None.
423	3	Disabled partner.	Disabled partner.	Refer to enclosure manufacturer's service manual.
424	3	Dual controllers entered nexus.	Dual controllers entered nexus.	None.
425	1	Controller boot ROM image needs to be reloaded.	Wrong firmware image file downloaded MAC address changed.	Contact your service representative to reload the boot ROM image.
426	0	Controller is using default non unique World-Wide Name.	MAC address lost or not set.	Contact your service representative to set the controller MAC address.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
427	2	Mirror race recovery failed.	Some physical disks may have failed.	Run consistency check and restore consistency.
428	0	Mirror race on critical logical drive.	Logical device is critical.	Replace failed physical disk and rebuild.
429	4	Controller connected to cluster.	One or more controllers detected during scan and entered nexus with those controllers.	None.
430	4	Controller disconnected from cluster.	All other controllers in cluster are inaccessible due to controller powered off or controller failure or cable failure.	If this was an unexpected event, refer to service manual and correct the failure.
431	3	Controller improperly shutdown! Data may have been lost.	User improperly shutdown the controller that resulted in inconsistent logical drive and/ or data loss.	Run consistency check to verify logical drive consistency. If needed, restore data from backup.
432	4	Dual-active automatic flash of replacement controller.	Replacement controller is being flashed with survivor's firmware.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
433	2	Dual-active negotiation failed jumpers.	Jumper settings do not match.	Replace, adjust, or add components so that the controllers have the same jumper settings.
434	2	Dual-active negotiation failed IDs.	Controller IDs are not unique. Both controllers have the same ID.	Replace, adjust, or add components so that the controllers have the correct IDs.
435	2	Dual-active negotiation failed board types.	Board types differ. Both controllers must be of the same type.	Replace appropriate controller so that the board types are the same.
436	2	Dual-active negotiation failed disk channels.	Number of disk channels differ. Both controllers must have the same number of disk channels.	Replace, adjust, or add components so that the controllers have the same number of disk channels.
437	2	Dual-active negotiation failed host ports.	Host ports differ. Both controllers must have the same number of host ports.	Replace, adjust, or add components so that the controllers have the same number of host ports.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
438	2	Dual-active negotiation failed memory size.	Memory sizes differ. Both controllers must have the same control store size.	Replace, adjust, or add components so that the controllers have the same control store size.
439	2	Dual-active negotiation failed cache memory size.	Cache memory sizes differ. Both controllers must have the same cache memory size.	Replace, adjust, or add components so that the controllers have the same cache memory size.
440	1	Error in mirror race table.	Logical drives appear in the mirror race table that don't exist in the configuration; possible data integrity issue.	Check configuration for accuracy, run consistency check and restore consistency.
441	2	A replacement controller attempted to stop the surviving controller.	Incompatible replacement controller firmware or hardware.	Obtain a compatible replacement contoller.
512	4	System started.	The server system (or array management utility server) started.	If you did not expect a system restart, investigate.
513	4	Size table full.	Too much physical disk size information is defined.	Remove unused size information from this system.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
514	4	User logged in.	An array management utility user logged in on the server system.	None.
515	4	User logged out.	An array management utility user logged out of the server system.	None.
516	4	Server alive.	Reconnected to server. Server rebooted.	None.
517	1	Lost connection to the server or server is down.	Lost network connection to the server. Server shut down.	None.
518	4	Automatic reboot count has changed.	Controller has rebooted. Automatic reboot has rearmed itself or was reconfigured.	None.
519	4	Battery test has started.	Battery test has started.	None.
520	4	Battery test complete.	Battery test complete.	None.
521	4	Battery test canceled.	Battery test canceled.	None.
522	2	Battery test failed - battery bad.	Battery test failed - battery bad.	Replace battery.
640	3	Channel failed.	Cable disconnected.	Plug in cable.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
641	3	Channel online.	Cable reconnected.	None.
642	1	Back End SCSI bus dead.	Lost access to data on SCSI bus.	None.
643	4	Back End SCSI bus alive.	Regained access to data on SCSI bus.	None.
644	1	Back End fibre dead.	Lost access to data on Fibre Channel.	Refer to the enclosure manufacturer's service manual.
645	4	Back End fibre alive.	Regained access to data on Fibre Channel.	None.
700	3	Event log empty.	Tried to read past last entry.	None.
701	3	Event log entries lost.	Tried to read an entry that does not exist in the event log.	None.
702	3	Request sense.	A physical drive has generated an error.	Interpret the Key/ASC/ASCQ and take appropriate action.
703	3	Set real time clock.	Real time clock was set.	None.
800	3	New configuration received.	A new configuration was downloaded to controller.	None.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
801	3	Configuration cleared.	Controller was told to clear the configuration.	None.
802	3	Configuration invalid.	The controller found an invalid configuration.	None.
803	3	Configuration on disk access error.	The controller could not read the configuration off of the disk.	None.
804	3	Configuration on disk converted.	The controller converted a down level configuration on disk.	None.
805	3	Configuration on disk import failed.	The controller could not import the configuration.	None.
806	4	A debug dump exists on this system.	The controller aborted and created debug dump information.	Contact field support for assistance in retrieving the data.
807	4	A debug dump exists on this system.	The partner controller aborted and created debug dump information.	Contact field support for assistance in retrieving the data.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
808	4	No valid Comfiguration On Disk (COD) found.	No physical disk contained a valid configuration on disk area. Physical disks were never written with COD. Physical disks were replaced while the controller system was offline.	Investigate if this is unexpected.
809	4	No valid SAN map found in Configuration On Disk (COD).	No physical disk contained a valid SAN map in its configuration on disk area. Physical disks may have been imported from a system that did not use SAN Mapping.	Investigate if this is unexpected.
896	1	Internal controller hung.	Internal controller is in the hung state.	Power controller off and on.
897	1	Internal controller firmware breakpoint.	Internal controller has encountered a firmware breakpoint.	Power controller off and on.
912	1	Internal controller i960 processor error.	Internal controller has encountered i960 processor specific error.	Power controller off and on.

Table A-2. SANArray Manager Events

ID	Severity	Description	Details	Actions
928	1	Internal controller Strong-ARM processor error.	Internal controller has encountered Strong-ARM processor specific error.	Power controller off and on.

Glossary

ANSI

American National Standards Institute, a standards organization that promotes and facilitates understanding among qualified members for the implementation of agreed upon code and signaling standards and conformity. ANSI represents the U.S. in the ISO (International Standards Organization).

Applet

Small application programs that are usually built into an operating system or a larger application program and designed to run from within another application. The built-in writing and drawing programs that come with Windows are sometimes called "applets." Applications that run in a web browser are often Java-based applets. See also *Java*.

Application Program

A program designed to perform a specific function directly for the user, or for another application program. Examples of application programs include word processors, database programs, Web browsers, development tools, drawing, paint and image editing programs, and communication programs.

Array

Multiple disk drives configured to behave as a single, independent disk drive. See also *Disk Array.*

Asynchronous Data Transfer

Data transfer not synchronized to a set timing interval. Asynchronous devices must wait for a signal from the receiving device after each byte of data. Compare with *Synchronous Data Transfer.*

Automatic Rebuild

Mylex controllers provide automatic rebuild capabilities in the event of a physical disk drive failure. The controller performs a rebuild operation automatically when a disk drive fails and both of the following conditions are true:

A standby or hot spare disk drive of identical or larger size is found attached to the same controller;

All system drives that are dependent on the failed disk drive are configured as a redundant array: RAID 1, RAID 3, RAID 5, or RAID 0+1.

During the automatic rebuild process, system activity continues; however, system performance may degrade slightly.

Automatic Switchover

See *Failover*

Background Initialization

Where the initialization process of a disk array takes place in the background, allowing use of a disk array within seconds instead of several hours. Also known as *Immediate RAID Availability.*

Benchmarks

A set of conditions or criteria against which a product or system is measured. Computer trade magazine laboratories frequently test and compare several new computers or computer devices against the same set of application programs, user interactions, and contextual situations. The total context against which all products are measured and compared is referred to as the benchmark. Programs can be specially designed to provide measurements for a particular operating system or application.

Berkeley RAID Levels

A family of disk array protection and mapping techniques described by Garth Gibson, Randy Katz, and David Patterson in papers written while they were performing research into I/O systems at the University of California at

Berkeley. There are six Berkeley RAID levels, usually referred to as RAID Level 0 through RAID Level 5. See also *RAID Levels.*

BIOS

Basic Input/Output System, software that determines what a computer can do without accessing programs. The BIOS contains all the code required to control the keyboard, screen, drives, serial communications, and other functions. Usually the BIOS is built into a ROM chip installed on the motherboard so that the BIOS will always be available and not affected by disk failure. Sometimes the BIOS is recorded on a flash memory chip.

BIOS Config Utility

BIOS-based Configuration Utility, a utility program sequence used, upon powerup, for configuring various hardware elements in a system.

Booting (or Bootstrapping)

Loading operating system code and other basic software from a disk or other storage device to help a computer start.

Cache

A temporary storage area for frequently accessed or recently accessed data. Cache is used to speed up data transfer to and from a disk. See also *Caching*.

Cache Flush

Refers to an operation where all unwritten blocks in a *Write-Back Cache* are written to the target disk. This operation is necessary before powering down the system.

Cache Line Size

Represents the size of the data “chunk” that will be read or written at one time, and is set in conjunction with stripe size. Under RAID EzAssist™, the cache line size (also known as *Segment Size*) should be based on the stripe size you selected. The default segment size for Mylex RAID controllers is 8K. See also *Stripe Size*.

Caching

Allows data to be stored in a pre-designated area of a disk or RAM. Caching speeds up the operation of RAID systems, disk drives, computers and servers, or other peripheral devices. See also *Cache*.

Conservative Cache

An operating mode in which system drives configured with the *Write-Back Caching* policy are treated as though they were configured for *Write-Through* operation and the cache is flushed.

Consistency Check

A process that verifies the integrity of redundant data. A consistency check on a RAID 1 or RAID 0+1 configuration (mirroring) checks if the data on drives and their mirrored pair are exactly the same. For RAID Level 3 or RAID Level 5, a consistency check calculates the parity from the data written on the disk and compares it to the written parity. A consistency check from Mylex utilities such as Global Array Manager™ (GAM) or RAID EzAssist™ give the user the ability to have a discrepancy reported and corrected. See also *Parity Check*.

Critical State

A *Logical Drive* is in a "critical" state if it has been configured at RAID level 1, 3, 5, or 0+1, and one (and only one) of its SCSI drives is not "online." A logical drive is considered "critical" because any failure of another of its SCSI drives may result in a loss of data.

Note: I/O operation can only be performed with system drives that are online or critical.

Cyclical Redundancy Check (CRC)

An error detection tool found on *Ultra 160 SCSI (Ultra3 SCSI)*. This tool increases the odds for error free data.

DACCF

Disk Array Controller Configuration File (utility), a diskette-based configuration utility for RAID configuration.

Data Transfer Rate

The amount of data per unit of time moved through a channel or *I/O bus* in the course of execution of an I/O load, usually expressed in MBps.

Degraded Mode

A RAID mode used when a component drive has failed.

Device Driver

A software program that controls a particular type of device attached to a computer, such as a RAID subsystem, printer, display, CD-ROM, disk drive, etc.

Disk Failure Detection

A RAID controller automatically detects SCSI disk failures. A monitoring process running on the controller checks, among other things, elapsed time on all commands issued to disks. A time-out causes the disk to be "reset" and the command to be retried. If the command times out again, the controller could take the disk "offline." Mylex DAC960 controllers also monitor SCSI bus parity errors and other potential problems. Any disk with too many errors will also be taken "offline." See also *Offline*.

Disk Media Error Management

Mylex controllers transparently manage disk media errors. Disks are programmed to report errors, even *ECC*-recoverable errors. If ECC RAM is installed, the controller will correct ECC errors. When a disk reports a media error during a read, the controller reads the data from the mirror (RAID 1 or 0+1), or computes the data from the other blocks (RAID 3, RAID 5), and writes the data back to the disk that encountered the error. When a disk reports a media error during a write, the controller issues a "reassign"

command to the disk, then writes the data out to a new location on the disk. Since the problem has been resolved, no error is reported to the system.

Drive Groups, Drive Packs

A group of individual disk drives (preferably identical) that are logically tied to each other and are addressed as a single unit. In some cases this may be called a drive "pack" when referring to just the physical devices.

All the physical devices in a drive group should have the same size; otherwise, each of the disks in the group will effectively have the capacity of the smallest member. The total size of the drive group will be the size of the smallest disk in the group multiplied by the number of disks in the group. For example, if you have 4 disks of 400MB each and 1 disk of 200MB in a pack, the effective capacity available for use is only 1000MB (5x200), not 1800MB.

Drivers

A software routine that receives I/O requests from higher levels within the operating system and converts those requests to the protocol required by a specific hardware device.

ECC

Error Correcting Code, a method of generating redundant information which can be used to detect and correct errors in stored or transmitted data.

EEPROM

Electrically Erasable PROM, see *EPROM*.

EPROM

Erasable Programmable Read Only Memory, memory which can be erased and re-used.

eXtremeRAID™

A family of Mylex RAID controllers which offer uncompromising fault tolerance, data availability, superior configuration, and management

flexibility. The eXtremeRAID controllers use driver technology, which has won tpm-C benchmarks worldwide. With this technology, eXtremeRAID controllers provide the highest performance and most flexible RAID solution available today.

FAT, FAT 32

File Allocation Table, a distribution table maintained by an operating system on a hard disk that provides a map of the clusters (the basic unit of logical storage on a hard disk) that a file has been stored in. FAT 32 supports 32-bit processors.

Fault Tolerance, Failure Tolerance

The ability of a system to continue to perform its function even when one of its components has failed. A fault tolerant system requires redundancy in disk drives, power supplies, adapters, controllers, and cabling. Mylex RAID controllers offer high levels of fault tolerance.

Flash ROM

Memory on an adapter containing software that can be reprogrammed without removing it from the board.

Format

A pre-established layout for data. Programs accept data as input in a certain format, process it, and provide it as output in the same or another format. All data is stored in some format with the expectation that it will be processed by a program that knows how to handle that format.

Gigabit

10^9 (1,000,000,000) bits. Abbreviated as Gb.

Gigabyte

2^{30} (1,073,741,824) bytes. Abbreviated as G or GB.

Global Array Manager (GAM)™

A Mylex RAID management utility that allows a system administrator to configure, monitor, and manage network RAID storage from anywhere in the world. GAM can communicate critical information via e-mail, fax, pager, SNMP, or the launching of an application. GAM is everything needed to manage Mylex PCI RAID Controllers, SCSI Host Adapters, and External RAID Controllers.

GUI

Graphical User Interface, a software interface that interacts with the user through color graphics and a mouse.

Immediate RAID Availability

See *Background Initialization*

Interface

A hardware or software protocol that manages the exchange of data between the hard disk drive and the computer. The most common interfaces for small computer systems are ATA (advanced technology attachments), also known as IDE (integrated drive electronics), and SCSI.

Internet

A worldwide system of computers that is a public, cooperative, and self-sustaining facility accessible to tens of millions of users worldwide.

Intranet

A network contained within an enterprise, the main purpose of which is usually to share company information and computing resources among employees. An intranet can also be used to facilitate working in groups and for teleconferences.

I/O

Input/Output, the transmission of information between an external source and the computer.

I/O Intensive

An application whose performance depends strongly on the performance of the I/O system.

I/Os Per Second

Number of I/O transactions per second.

I_2O

Intelligent Input/Output, a driver that uses special I/O processes to eliminate I/O bottlenecks. The processes deal with interrupt handling, buffering, and data transfer. An I_2O driver also includes an OS-specific module (OSM), which handles higher-level OS details, and a hardware device module (*HDM*), which knows how to communicate with certain devices.

ISM

Integrated Software Module, part of the I_2O package that helps operators insert special functions into the I_2O.

Java

A programming language expressly designed for use in the distributed environment of the *Internet* and enforces a completely object-oriented view of programming. Java can be used to create complete *application programs* that may run on a single computer or be distributed among servers and clients in a network. It can also be used to build small application modules, or *applets*, for use as part of a Web page.

Kilobyte

2^{10} (1,024). Abbreviated as K or KB.

LAN

Local Area Network, a network of interconnected workstations sharing the resources of a single processor or server, typically within the area of a small office building.

Latency

1. The time between the making of an I/O request and completion of the request's execution. 2. Short for rotational latency, the time between the completion of a seek and the instant of arrival of the first block of data to be transferred at the disk's read/write head.

Logical Drive

The logical devices presented to the operating system. System drives are presented as available disk drives, each with a capacity specified by the Mylex RAID controller. See also *Storage Device*.

Logical Drive States

A logical (system) drive can be *Online*, *Critical*, or *Offline*. Notice that the term "online" is used for both physical and logical drives.

LUN

Logical Unit Number, a SCSI representation of a system drive on a given channel and target ID. This may be a single device or an array of devices configured to behave as a single device.

LUN Mapping

A method whereby a LUN ID is assigned to a system drive, allowing a LUN to be made accessible through specific controllers and ports using system drive affinity.

LVD

Low Voltage Differential, a form of SCSI signaling introduced with *Ultra2 SCSI (Fast 40 SCSI)*. LVD uses data high and data low signal lines to increase transmission distances over those of single-ended (conventional SCSI signaling) lines. LVD allows for cable lengths of up to 12 meters (approximately 39 feet) with up to 15 drives. LVD also lowers noise, power usage, and amplitude.

LVD differs from conventional differential signaling in that only positive and negative values are distinguished, not voltage levels. Other advantages are

that LVD devices consume less power and can sense single-ended devices on the bus and revert to single-ended signaling. Devices need to be Ultra2 SCSI LVD drives in order to take advantage of the LVD signaling. Mylex AcceleRAID, eXtremeRAID, and DAC FL controllers are LVD controllers.

Megabit

A million bits; used as a common unit of measure, relative to time in seconds, as an expression of a transmission technology's bandwidth or data transfer rates (abbreviated as Mb). Megabits per second (Mbps) is a frequent measure of bandwidth on a transmission medium.

Megabyte

2^{20} (1,048,576) bytes. One megabyte can store more than one million characters. Abbreviated as M or MB.

Mirrored Cache

A cache memory that has duplicate data from another controller. In the event of failure of the original controller, the second controller can take the cached data and place it on the disk array.

Mirroring

The complete duplication of data on one disk drive to another disk drive, this duplication occurs simultaneously with each write operation: each disk will be the mirror image of the other (also known as RAID Level 1, see *RAID Levels*). All Mylex RAID controllers support mirroring.

M.O.R.E.™

Mylex Online RAID Expansion, an advanced configuration mode that allows expansion of any unconfigured or hot spare drive into the expandable drive group while the controller is online with the host. For example, a system using a five-disk-drive RAID set can add another disk drive to create a six-disk-drive RAID set. The M.O.R.E. operation can be performed on all RAID levels except JBOD.

Mylex's Global Array Manager (GAM) supports two M.O.R.E. features:

- Expand Capacity allows logical drive expansion for FFx external controllers only.
- Expand Array allows array expansion for both PCI and FFx external controllers.

During the RAID set expansion process, which includes re-striping data from the old (smaller) RAID set to the new (expanded) RAID set, the controller continues to service host I/O requests.

NFS

Network File System, a client/server application that lets a computer user view and optionally store and update files on a remote computer as though they were on the user's own computer. See also *File Server.*

NOS

Network Operating System, an operating system that has special features for connecting computers and peripheral devices into a *LAN*.

NVRAM

Non-Volatile Random Access Memory, a memory unit equipped with a battery so that the data stays intact even after the main power had been switched off.

Offline

A *Logical Drive* is in an “offline” state if no data can be read from it or written to it. Offline does not apply to physical disk drives. System commands issued to offline logical drives are returned with an error status; no operations can be performed on offline logical drives. See also *Logical Drive States*, *Critical State*, and *Online*

OLTP

Online Transaction Processing, computer processing where the computer responds immediately to user requests.

OS

Operating System, software that manages the system resources and provides the operating environment for application programs.

Parity

A method of providing complete data redundancy while requiring only a fraction of the storage capacity of mirroring. The data and parity blocks are divided between the disk drives in such a way that if any single disk drive is removed or fails, the data on it can be reconstructed using the data on the remaining disk drives. The parity data may exist on only one disk drive or be distributed between all disk drives in a RAID group. See also *Rotated XOR Redundancy.*

Parity Check

A function used to verify the integrity of data on a system drive. It verifies that mirror or parity information matches the stored data on the redundant arrays. If the parity block information is inconsistent with the data blocks, the controller corrects the inconsistencies. See also *Consistency Check*.

Partitioning

Where the full usable storage capacity of a disk or array of disks appears to an operating environment in the form of several virtual disks whose entire capacity approximates that of the underlying disk or array.

Physical Device

Any device connected to some kind of hardware. For example, SCSI disk, fibre disk, network disk, RAM disk, etc.

Platform

An underlying computer system on which application programs can run. A platform consists of an operating system, the computer system's coordinating program, and a microprocessor, the microchip in the computer that performs logic operations and manages data movement in the computer.

Plug and Play

The ability to install peripheral cards or other devices without requiring manual configuration by the user.

PROM

Programmable Read-Only Memory, memory that users with appropriate instructions can reprogram.

Protocol

A special set of rules for transmitting data between two devices in a telecommunication connection.

Queue

A line of things, commands, or data waiting to be handled, usually in sequential order starting at the beginning or top of the line or sequence.

RAID

Redundant Array of Independent Disks, a collection of two or more disks working together in an array. Mylex RAID controllers implement this technology to connect up to 15 SCSI devices per channel. The different forms of RAID implementation are known as "RAID levels." See also *Berkeley RAID Levels*, *Disk Array*, and *RAID Levels*.

The system manager or integrator selects the appropriate RAID level for a system. This decision will be based on which of the following are to be emphasized:

- Disk Capacity
- Data Availability (redundancy or fault tolerance)
- Disk Performance

RAID Advisory Board (RAB)

An association of companies whose primary intention is to standardize RAID storage systems. IBM is a member of RAB.

RAID EzAssist™

A Mylex RAID management utility for configuration and maintenance of RAID controllers.

RAID Levels

Mylex disk array controllers support four RAID Advisory Board approved (RAID 0, RAID 1, RAID 3, and RAID 5), two special (RAID 0+1, and JBOD), and three spanned (RAID 10, 30, and 50) RAID levels. All DAC960, AcceleRAID, and eXtremeRAID series controllers support these RAID levels. See also *Berkeley RAID Levels*.

Level 0: Provides block "striping" across multiple drives, yielding higher performance than is possible with individual drives. This level does not provide any redundancy.

Level 1: Drives are paired and mirrored. All data is 100 percent duplicated on a drive of equivalent size.

Level 3: Data is "striped" across several physical drives. Maintains parity information which can be used for data recovery.

Level 5: Data is "striped" across several physical drives. For data redundancy, drives are encoded with rotated XOR redundancy.

Level 0+1: Combines RAID 0 striping and RAID 1 mirroring. This level provides redundancy through mirroring.

JBOD: Sometimes referred to as "Just a Bunch of Drives." Each drive is operated independently like a normal disk controller, or drives may be spanned and seen as a single drive. This level does not provide data redundancy.

Level 10: Combines RAID 0 striping and RAID 1 mirroring spanned across multiple drive groups (super drive group). This level provides redundancy through mirroring and better performance than Level 1 alone.

Level 30: Data is "striped" across multiple drive groups (super drive group). Maintains parity information, which can be used for data recovery.

Level 50: Data is "striped" across multiple drive groups (super drive group). For data redundancy, drives are encoded with rotated XOR redundancy.

Note: The host operating system drivers and software utilities remain unchanged regardless of the level of RAID installed. The controller makes the physical configuration and RAID level implementation.

RAID Migration

A feature in RAID subsystems that allows for changing a RAID level to another level without powering down the system.

RAM

Random Access Memory, the "built-in" readable and writable data storage that comes with (or can be added to) a computer.

Read-Ahead Cache

A caching strategy whereby the computer anticipates data and holds it in cache until requested.

Recovery

The process of reconstructing data from a failed disk using data from other drives.

Redundancy

The inclusion of extra components of a given type in a system (beyond those the system requires to carry out its functions).

Replacement Table

A table that contains information regarding which SCSI devices have been replaced by others through standby replacement.

ROM

Read-Only Memory, built-in computer memory containing data that normally can only be read, not written to. ROM contains the programming that allows a computer to be "booted up" each time you turn it on. Unlike a computer's random access memory (*RAM*), the data in ROM is not lost when

the computer power is turned off; the ROM is sustained by a small long-life battery in your computer.

Rotated XOR Redundancy

XOR refers to the Boolean "Exclusive-OR" operator. Also known as *Parity*, a method of providing complete data redundancy while requiring only a fraction of the storage capacity of mirroring. In a system configured under RAID 3 or RAID 5 (which require at least three SCSI drives), all data and parity blocks are divided amongst the drives in such a way that if any single drive is removed (or fails), the data on it can be reconstructed using the data on the remaining drives. In any RAID 3 or RAID 5 array, the capacity allocated to redundancy is the equivalent of one drive.

RTC

Real-Time Clock, a clock that keeps track of the time with its own power supply.

SAF-TE

SCSI Accessed Fault-Tolerant Enclosure, an "open" specification designed to provide a comprehensive standardized method to monitor and report status information on the condition of disk drives, power supplies, and cooling systems used in high availability *LAN* servers and storage subsystems. The specification is independent of hardware I/O cabling, operating systems, server platforms, and RAID implementation because the enclosure itself is treated as simply another device on the SCSI bus. Many other leading server, storage, and RAID controller manufacturers worldwide have endorsed the SAF-TE specification. Products compliant with the SAF-TE specification will reduce the cost of managing storage enclosures, making it easier for a LAN administrator to obtain base-level fault-tolerant alert notification and status information. All Mylex RAID controllers feature SAF-TE.

SAN

See *Storage Area Network*

SANArray™

Server-independent *External RAID Controllers* that provide fibre channel interface connections to loop or fabric topologies and dual redundant loops for continuous access to large data pools. These controllers are designed for homogeneous and heterogeneous operating system setups in *Storage Area Network* environments.

SANmapping™

A feature of SANArray external controllers, SANmapping manages drive allocation and access, and is similar to the programmable LUN Mapping feature, which is incorporated into this feature. SANmapping is intended for use in configurations in which multiple host computers attach to one or more Mylex controllers or to a *Storage Area Network (SAN)* configuration.

SDRAM

Synchronous Dynamic Random Access Memory, a form of dynamic random access memory (DRAM, a type of memory used in computers) that can be coordinated or synchronized to the clock speed of the computer.

Sector

The unit in which data is physically stored and protected against errors on a fixed-block architecture disk.

Segment Size

See *Cache Line Size*

Sequential I/O

A type of read and write operation where entire blocks of data are accessed one after another in sequence, as opposed to randomly.

Server

A computer program that provides and manages services to other computer programs on the same or other computers. The computer that a server

program runs on is also frequently referred to as a server. See also *Application Server.*

Session

The period of time between any two consecutive system shutdowns; system shutdown may be either a power off/on, or a hardware reset.

SMART

Self-Monitoring Analysis and Reporting Technology, the industry standard reliability prediction indicator for both the ATA/IDE (advanced technology attachments/integrated drive electronics) and SCSI hard disk drives. Hard disk drives with SMART offer early warning of some hard disk failures so critical data can be protected.

SMB

Server Message Block protocol, a method for client applications in a computer to read and write to files on, and to request services from server programs in, a computer network. A client application can read, create, and update files on the remote server. It can also communicate with any server program that is set up to receive an SMB client request.

SNMP

Simple Network Management Protocol, the protocol governing network management: for monitoring network devices and their functions.

Software Driver

Set of utilities and instructions for controllers to work in a specific operating system environment.

Spanning

A process that provides the ability to configure multiple drive packs or parts of multiple drive packs. In effect, spanning allows the volume used for data processing to be larger than a single drive. Spanning increases I/O speeds, however, the probability of drive failure increases as more drives are added

to a drive pack. Spanned drive packs use striping for data processing. See also *Striping* and *Drive Groups, Drive Packs*.

Storage Area Network (SAN)

A high-speed, open-standard scalable network of storage devices and servers providing accelerated data access.

Stripe Order

The order in which SCSI disk drives appear within a drive group. This order must be maintained, and is critical to the controller's ability to "rebuild" failed drives.

Stripe Size

The size, in kilobytes (1024 bytes) of a single I/O operation. A stripe of data (data residing in actual physical disk sectors, which are logically ordered first to last) is divided over all disks in the drive group.

Stripe Width

The number of striped SCSI drives within a drive group.

Striping

The storing of a sequential block of incoming data across multiple SCSI drives in a group. For example, if there are 3 SCSI drives in a group, the data will be separated into blocks. Block 1 of the data will be stored on SCSI drive 1, block 2 on SCSI drive 2, block 3 on SCSI drive 3, block 4 on SCSI drive 1, block 5 on SCSI drive 2, and so on. This storage method increases the disk system throughput by ensuring a balanced load among all drives.

Sustained Data Transfer Rate

A rate of data transfer defined for continuous operation at a maximum speed level.

Synchronous Data Transfer

Data transmission synchronized to a defined time interval, and is faster than asynchronous SCSI because there is no wait for acknowledgement of each byte from the receiving device (up to 20MHz). Compare with *Asynchronous Data Transfer.*

System Disk

The disk on which a system's operating software is stored.

System Drives

See *Logical Drives*

TCP/IP

Transmission Control Protocol/Internet Protocol, the basic communication language or protocol of the Internet. It can also be used as a communications protocol in intranets and extranets. When set up with direct access to the Internet, a computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

Terabyte

A measure of memory capacity, 2^{40} power; or roughly a thousand billion bytes (that is, a thousand gigabytes).

Throughput

The number of I/O requests satisfied per unit of time (usually per second).

TPC-C, Tpm-C

The Transaction Processing Performance Council (TPC) is a standards organization that measures transaction throughput of systems. One of their benchmarks is Tpm-C, which reflects price and performance metrics. TPC-C reflects new order transaction rate, a benchmark for transaction speed. Mylex products have won consistently high TPC-C results.

Transfer Rate

The rate at which data moves between the host computer and storage, input, or output devices, usually expressed as a number of characters per second.

WAN

Wide Area Network, a geographically broader telecommunication structure as opposed to a local area network (*LAN*) that comprises of two or more LANs. A wide area network may be composed entirely of private structures, but the term also seems to connote the inclusion of public networks and all kinds of transmission media.

Web

A number of computers, servers, or networks linked together in a matrix. See also *Internet* and *Intranet*.

Write-Back Cache

A caching strategy whereby write operations result in a completion signal being sent to the host operating system as soon as the cache (not the disk drive) receives the data to be written. The target disk drive will receive the data at a more appropriate time in order to increase controller performance. An optional cache battery backup can be used to protect against data loss as a result of a power failure or system crash.

Write-Through Cache

A caching strategy whereby data is written to the SCSI drive before a completion status is returned to the host operating system. This caching strategy is considered more secure, since a power failure will be less likely to cause loss of data. However, a write through cache results in a slightly lower performance.

XOR

Exclusive “Or”, a computer language function that generates parity in RAID systems; “this or that but not both.”

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